Western Science

Department of Biology

The Physiology of Animal Migration
BIO4611G Winter 2026
Course Outline

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Course Information

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Lectures: Tuesdays 9:30 – 11:30am
Thursdays 10:30 – 11:30am

List of Prerequisites
Either Biology 2601A/B or Physiology 3120, and either completion of at least 1.5 Biology courses from the 3000-level or above, or registration in Year 4 of an Honors Specialization in Animal Behaviour.

Senate's regulation on prerequisites: "Unless you have either the requisites for this course or written special permission from your Dean's Designate (Department/Program Counsellors and Science Academic Advisors) to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites."

Instructor Information

Corrine Génier, MSc, PhD
Department of Biology & Centre for Animals on the Move
cgenier@uwo.ca
Office hours by appointment: Location to be determined or by Zoom.

Students must use their Western (@uwo.ca) email addresses when contacting instructors by email.

Course Description, Learning Outcomes, and Delivery Mode

Course description
Migration is an amazing natural phenomenon and an important component of the life history of many species. The goal of this course is to examine the physiological basis of migratory movements in invertebrate and vertebrate animals. Topics covered include (1) the evolution of migratory life histories, (2) biological rhythms and hormonal control of migration, (3) the sensory basis of orientation and navigation, (4) biomechanics and energetics of movement, (5) metabolic fuel storage and utilization, (6) stable isotope, radar, radio-telemetry and other tracking methods, (7) physiological approaches to the study of migration ecology, (8) conservation of migratory species.

Learning Outcomes
Upon successful completion of this course, students will be able to:

1) Distinguish between migratory movements and other types of movement of volant organisms.
2) Describe and compare historical through current primary methods used to track migratory animals.
3) Explain the primary abiotic mechanisms influencing animal movements in terrestrial and aquatic environments.
4) Describe and differentiate the primary mechanisms used by animals to orient and navigate.
5) Describe how migratory ability is influenced by ontogeny.
6) Explain the primary physiological mechanisms of biological clocks and circadian rhythms.
7) Explain the mechanics and energetics of animal movement through air and water.
8) Describe how energy for movement is derived from diet through macromolecular pathways.
9) Describe and contrast methods used to quantify animal metabolism related to migratory movements.
10) Identify the ecological and physiological consequences of fueling migration from dietary and stored nutrients.
11) Explain how the endocrine system controls migration.
12) Demonstrate the challenges related to full life cycle conservation of migratory animals.
13) Assess primary literature on course topics and evaluate their communication, research approach, and findings.
14) Formulate a research proposal with peer and mentor guidance to study migration in a topic area covered in the course.

Delivery Mode
This course will use a combination of lectures and readings from the primary literature to develop a knowledge base on migration physiology. Primary literature readings will be discussed in groups during class. Students' understanding and analysis of the research will be evaluated through short written answers to questions on the readings and hands-on activities. These in-class activities require active participation by students and attendance to lecture periods is mandatory. This course includes a midterm and final exam, and two writing assignments with the second building from the first. Each component is described below under Assessments.

Participation and Inclusivity: Online and in-class
This course relies on students consistently accessing the course OWL site (https://westernu.brightspace.com/) to retrieve course materials and assessments. Other online tools may be introduced during the course (e.g., google forms) and students are expected to be engaged with the available resources and the OWL site throughout the course. If Brightspace is new to you, please spend

some time familiarizing yourself with the site and other courses. Ask for help if you find yourself struggling with any of the digital tools used at any point in the course.

This course also relies on consistent in-class participation, and as a student you are expected to engage meaningfully in the classroom. As members of a diverse classroom community, you will use your self-monitoring skills to discern when you have contributed enough to a conversation or when it is the right time to make a contribution. Please take note that the quality of your contributions to the course dialogue are more important than their quantity. As a class, we are committing to co-create a learning environment to welcome and respect all participants and a plurality of views. From this we will collectively support inclusivity by striving to create space for the contributions of others' views, which helps challenge our preconceived notions.

Course Materials

Technical Requirements
Stable internet connection and computer.

Required Readings
There is no required textbook for this course.

Required primary literature readings and necessary lecture materials will be posted on the course OWL site (i.e., Brightspace).

This course will use a combination of lectures and readings from the primary literature to develop a knowledge base on migration physiology. The material in this course is inspired in part from *Migration, The Biology of Life on the Move*, First (1996) and Second (2014) editions by Hugh Dingle, but this textbook is not required for the course. Required readings and necessary lecture materials posted on OWL are meant to aid in the understanding of the information presented in lecture, so attendance to lectures is mandatory.

Resources
All course material will be posted to OWL: https://westernu.brightspace.com/

Students are responsible for checking the course OWL site (https://westernu.brightspace.com/) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the OWL Brightspace Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

Assessments

The overall course grade will be on a traditional percentage scale and calculated as listed below:

	Assessment	Percent Value	Date
Participation	Class participation	4%	Tuesdays and Thursdays in class (see course schedule)
Assignments	Literature and group activities (top 7 at 3% each)	21%	Tuesdays in class (see course schedule)
	Letter of Intent	10%	Feb 12
	Written proposal	25%	Peer-review due Mar 26 Final proposal due Apr 2
Exams	Midterm	15%	Feb 26
	Final Exam	25%	To be determined

Participation: 4%
This course involves lecture based and active learning components and thus require participation and contributions by students throughout. Participation throughout the course will be evaluated by the instructor through:

- Engagement with literature analysis assignments and activities in-class
- Completion of course surveys or question of the day

Literature Analysis and Group Activities: 21%
Learning to read, understand and evaluate the scientific literature is a crucial skill for science students. You will be assigned 2 papers bi-weekly to read before the Tuesday class (see course schedule). In groups of ~5, students will discuss one of the papers as selected by the instructor and answer questions related to the article on the day of class. These assignments are designed to be completed during class in groups and require students to come prepared having read the article and understand its central topic, hypothesis or question, research approach, and findings. Students will be able to refer to the paper during the class to aid discussions and when answering the questions, but there will not be sufficient time to begin familiarizing yourself with the article in class. It is equally important for students to become critical thinkers by applying their knowledge to hypothetical scenarios. On alternating Tuesdays with the paper discussions, hands-on activities will have students apply the course knowledge to a hypothetical problem and answer questions as a group of ~5 students. Grades will be assigned groupwise and students will provide peer contribution assessments later in the course. The top 7 assignments will be considered and valued at 3% each.

Letter of intent: 10%
and Research Proposal: 25%
Developing writing skills is important for improving science communication and analysis. These assignments provide students with the opportunity to develop a novel idea into a scientific study and communicate the relevance of your research to the general public in a scaffolded process. You will first write a one-page letter of intent for a research proposal. You will receive written feedback on your letter of intent from the instructor and have the opportunity to discuss the details prior to completing the research proposal. You will then write a full research proposal (description to be provided) first for peer review in class by exchanging your completed proposal with another student. Students will have the opportunity to incorporate comments made during peer review into the final proposal to be submitted for grading. Both the peer review and the final research proposal will be graded together.

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Midterm: 15%
and Final Exam: 25%
Both midterm and final exams will be cumulative evaluations. Exam questions will be drawn from the lectures and assigned readings. Students will be able to complete the academic integrity tutorial and submit two questions that may be used in each exam (see course schedule for deadlines) for bonus marks. Questions may include multiple choice, fill-in the blanks, diagram drawings, and short answers. Electronic devices will not be required or permitted during exams. The midterm will take place during class (see course schedule) and the final exam will be scheduled during the exam period, date to be determined.

Late assignments will be penalized 10% for each day after the due date including weekends. Assignments not turned in will receive a grade of zero (0). Further information is listed below under Policies on Missed Coursework.

Course Schedule
Tues 9:30-11:30 / Thurs 10:30-11:30
Topic timeline is tentative

Week	Dates	Topic	Assignments
1	Jan 6/8	Introduction to the course and migration	Group selection
2	Jan 13/15	Movement	Literature analysis - In class Tues 13 Introduction survey due Tues 13
3	Jan 20/22	Methods	Group activity - In class Tues 20
4	Jan 27/29	Evolution	Literature analysis - In class Tues 27
5	Feb 3/5	Clocks	Letter of intent workshop Tues 3 Academic Integrity due Tues 3
6	Feb 10/12	Winds	Literature analysis - In class Tues 10 Midterm questions due Tues 10 **Letter of intent due Thurs 12 at 23:59**
	Feb 14-22	Reading Week	NO CLASS
7	Feb 24/26	Review	Group activity – In class Tues 24 **Midterm (in-class) Thurs 26**
8	Mar 3/5	Orientarion/Navigation	Literature analysis - In class Tues 3
9	Mar 10/12	Biomechanics	Group activity - In class Tues 10
10	Mar 17/19	Fuel	Literature analysis - In class Tues 17
11	Mar 24/26	Exercise	Proposal review workshop Tues 24 **Proposal Review due Thurs 26**
12	Mar 31/Apr 2	Hormones	Group activity – In class Tues 31 Final questions due Tues 31 **Final proposal due Thurs 2 at 23:59**
13	Apr 7	Review	Final survey due Tues 7 **Final Exam (TBD)**

Last day of classes: April 9 Final exam period: April 12-30

Policies on Missed Coursework

General information about missed coursework
Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage:
https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

All Academic Consideration requests normally must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, examinations scheduled during official examination periods (i.e., the final exam) are excluded from this, and therefore always require formal supporting documentation.

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments
Late written assignments will be penalized 10% for each day after the due date including weekends. Assignments not turned in will receive a grade of zero (0). See Coursework with Assessment Flexibility below for more detail on literature analysis, letter of intent, and research proposal writing assignments. Missed exams (midterm and final) without academic consideration will receive a grade of zero (0).

Grades from a missed midterm exam **with** academic consideration will be reweighted to the final exam.

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under Special Examinations), especially for those who miss multiple final exams within one examination period.

Essential Learning Requirements
Even when Academic Considerations are granted for missed coursework, the following are deemed essential to earn a passing grade.

- Contribute to and complete 4 literature analysis or group assignments.
- Achieve a passing grade on the written Research Proposal.
- Achieve a minimum average grade of 40% on the midterm and final exam.

If any of these essential learning requirements are not achieved, students will receive a grade of Fail (F).

Coursework with Assessment Flexibility
By policy, instructors may deny Academic Consideration requests for the following assessments with built-in flexibility:

Flexible Completion
Literature Analysis and Group Activities. This course has 9 literature analysis and group assignments. Students will only receive credit for these assignments where they participated in class. Should extenuating circumstances arise, students do not need to request Academic Consideration for the two missed literature analysis because the top 7 marks will be used for the cumulative grade of these assignments. Academic Consideration requests may be granted for further missed literature analysis or group assignments and reweighted.

Deadline with a No-Late-Penalty Period
Letter of Intent and Research Proposal only. Students are expected to submit each of the final Letter of Intent and Research Proposal assignments by the deadline listed. Should extenuating circumstances arise, students do not need to request Academic Consideration, but must communicate with the instructor as soon as possible. Students are then permitted to submit their assignment up to 48 hours past the deadline without a late penalty. Should students submit their assessment beyond 48 hours past the deadline, a late penalty of 10% per day will be applied. However, the late penalty will be applied immediately for the peer-review component of the research proposal. Academic Consideration requests may be granted only for extenuating circumstances that started before the deadline and lasted longer than the No-Late-Penalty Period.

Additional Statements

Religious Accommodation
When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination.

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays:

https://www.edi.uwo.ca.

Accommodation Policies
Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf.

Academic Policies
The website for Registrar Services is https://www.registrar.uwo.ca/.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

Electronic Devices
Use of electronic devices is not permitted during tests and exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Support Services
Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic-related matters: https://www.uwo.ca/sci/counselling/.

Students who are in emotional/mental distress should refer to Mental Health@Western (https://uwo.ca/health/) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (https://learning.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Additional student-run support services are offered by the USC, https://westernusc.ca/services/.