

Biology 3444 A
Molecular Ecology
(Western University, Canada)

Fall 2023

Professor: Dr. Nusha Keyghobadi (*she/her*)

Brief Course Description: An introduction to the use of molecular tools, particularly genetic tools, in addressing both basic and applied questions in ecological research. We will consider the use of molecular tools for addressing questions in population, behavioural, community and ecosystem ecology. We will also consider various areas of practical application such as species conservation, studies of the origin and spread of invasive species, wildlife forensics, and agriculture and fisheries. Lectures and student-led seminars will develop basic knowledge and theory underlying molecular ecology, and will present many recent case studies from the primary literature.

Prerequisites: Biology 2483 (Ecology) and Biology 2581 (Genetics). Biology 3466 (Evolutionary Genetics) would be helpful and is recommended as a pre- or co-requisite, but is not required.

It is your responsibility to ensure that you have the prerequisites for this course. Unless you have either the requisites for this course, or written special permission from your Dean 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.

Course learning objectives: Upon successful completion of the course students should be able to: (i) identify, describe, and compare different types of molecular markers commonly used in molecular ecology, (ii) understand and describe, by drawing on basic principles of inheritance and population genetics, how molecular markers can be applied to address a broad variety of ecological questions, (iii) read and critically evaluate primary research articles in the field of molecular ecology, (iv) articulate a research question, and associated hypotheses and predictions, in the field of molecular ecology, and plan out and describe suitable methods to answer the question.

Office Hours: By appointment. Please send me an email and we can arrange a meeting.

OWL: Materials for the course will be available on OWL. Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated in the class.

Contacting the instructors: Please do not send us messages or emails through OWL; contact us using our @uwo.ca email instead. Conversely, students must use their Western (@uwo.ca) email address when contacting the instructor or TA; to protect your privacy, we cannot respond to messages from other email accounts.

COVID-19 Contingency Plan: In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

Textbooks:

- **Required:** Freeland, J. R., 2019. *Molecular Ecology (3rd ed'n.)*. John Wiley & Sons. **Note:** The first and second edition have some important differences from the third edition, so buying earlier edition texts is not recommended.
- Additional readings will be provided as pdfs on OWL
- If you want further background in basic population genetics, the following books may be helpful:
 - ❖ Halliburton, R. *Introduction to Population Genetics*. Pearson Education.
 - ❖ Hartl, D. L. *A Primer of Population Genetics, 3rd Ed'n*. Sinauer & Associates.
 - ❖ Frankham, R., J. D. Ballou, & D. A. Briscoe. *Introduction to Conservation Genetics*. Cambridge University Press.

Electronic Devices: Students should bring a laptop to tutorials for completing simulation- and analysis-based assignments. Please let me know if you do not have access to a compatible device.

Evaluation:

Tutorial Exercises (best 4 of 6 will be counted)	20%
Midterm Test – essay format, open book – Oct. 17th (during class time)	15%
Proposal outline – due Oct. 26th	10%
Group Evaluation of Research Proposal Outlines – Nov. 9th (in class)	5%
Research Proposal – due Dec. 5th	20%
Final Exam - essay format, open book – during Exam Period	30%
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Total	100%

At the end of term you will be handing in a ‘Research Proposal’, which will be a brief but formal description of a proposed research project in the field of Molecular Ecology. Students are free to work on any question or study system of their choice, as long as the topic fits within the scope of Molecular Ecology (check with the instructor or TA if you aren’t sure about a particular topic). The Research Proposal proposes a question and a clearly stated scientific hypothesis to be tested.

It provides background information on the question and hypothesis, including some justification for why the topic is interesting or important. It also provides detailed description and justification of the methods that will be used to answer the question and test the hypothesis.

As many students are not familiar with writing a research proposal, the 'Research Proposal Outline' is designed to help you prepare for the longer 'Research Proposal' assignment. This Outline assignment involves formulating your question and hypothesis, providing a brief amount of background information that explains why the topic is interesting or important, and a point-form outline of the methods you would propose to use. A bibliography of relevant research papers is also required. You will be graded on the Outline, and the TA will provide feedback that is intended to help you write the full Research Proposal. These Outlines will also be reviewed by your peers during the 'Group Evaluation of Research Proposal Outlines'.

A midterm test will be written during class time. It will cover all material presented during lectures and tutorials (up to, and including, Oct. 5th), and in the assigned readings. It will be in essay format and you will be allowed to use your class notes and textbook in writing your answers. The test will be in person, but you will be writing on your laptop. Phones are not permitted.

A final test will be written during the exam period. It will be comprehensive, and cover all material presented during lectures and tutorials and in the assigned readings for the entire term. It will be in essay format and you will be allowed to use your class notes and textbook in writing your answers. The exam will be in person, but you will be writing on your laptop. Phones are not permitted.

Most tutorial sessions (six of them to be exact) will involve an exercise, or series of exercises, along with an assignment to be completed during the class time. It is very strongly recommended that you complete and hand in all of the tutorial assignments. However, only your top four assignments will count towards 20% of your final grade (i.e., at 5% each).

Missing assignments and tests: If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

Assessments worth less than 10% of the overall course grade (i.e., the 'Group Evaluation of Research Proposal Outlines'): This exercise and assessment will occur entirely during class time; if you miss this class, the weight of your Research Proposal will increase from 20% to 25%.

Assessments worth 10% or more of the overall course grade: For work totalling 10% or more of the final course grade, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf.

The Student Medical Certificate is available at https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

One makeup midterm test will be provided. If you miss both the midterm and its makeup (for reasons approved by the academic counsellors), that grade will be re-weighted to your final

exam. For other assignments, an extension will be provided based on the recommendation of the academic counsellors.

Absences from Final Exam: If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If you miss a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

Late submission of work: All work that is handed in late, without an approved extension as outlined above, will be penalized 10% of the value of the assignment for each day (or part of a day) that it is late, including weekend days.

Scholastic Offences: All students are expected to know, understand, and follow the codes of conduct regarding scholastic offences. 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:

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

Please review this information and ask your professor if you have any questions about how it applies to this course.

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>).

Religious Accommodation: When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

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.

Additional Resources and Supports:

Please visit the Science & Basic Medical Sciences Academic Counselling 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 the Student Development Centre (<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.

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

BIO 3444A: Tentative Lecture Schedule 2023

Date	Topic	Chapters from text
Sept. 12	<ul style="list-style-type: none">• Overview of course.• What is Molecular Ecology?• History of Molecular Ecology.• Overview of relevant techniques and methods.	1
Sept. 19	Molecular markers: Characteristics and how to choose the right one.	2
Sept. 26	Primer of Population Genetics	5 & 6 (pages 197 – 204, 223-226)
Oct. 3	Identifying species, individuals, and sex.	3 & 6 (pages 204-207)
Oct. 10	Molecular tools in behavioural ecology	7
Oct. 17	Midterm Test	
Oct. 24	Conservation Genetics	8
Oct. 31	FALL READING BREAK	
Nov. 7	Molecular tools in community and ecosystem ecology	3 & Additional readings that will be provided
Nov. 14	Molecular basis of ecologically important traits	6 (pages 218-221) & Additional readings that will be provided
Nov. 21	Phylogeography and landscape genetics	4 & 6 (pages 209-223)
Nov. 28	Review and/or guest lecture	
Dec. 5	Research Proposal due	

BIO 3444A: Tentative Tutorial Schedule 2023

Date	Topic / Activity
Sept. 14	What is a Research Proposal? Coming up with Research Proposal ideas.
Sept. 21	Choosing and Using a Molecular Marker.
Sept. 28	Population Genetics Simulations.
Oct. 5	Population Assignment Exercise.
Oct. 12	Parental Assignment Exercise.
Oct. 19	No Tutorial – TA available for consultation on proposals
Oct. 26	Conservation Genetics: simulating bottlenecks and founder effects Proposal Outline Due
Nov. 2	FALL READING BREAK
Nov. 9	Group Evaluations of Proposal Outlines
Nov. 16	No Tutorial – TA available for consultation on proposals
Nov. 23	Landscape Genetics Simulations
Nov. 30	No Tutorial – TA available for consultation on proposals