

1. Course Information

Evolutionary Genetics - Biology 3466B

The Winter 2024 edition of *Evolutionary Genetics* is an all in-person course consisting of lectures and labs. I will post lecture slides twice per week to coincide with our Monday and Thursday lectures. The labs will likewise unfold each week but with some weeks being lab-free, according to a schedule. The labs complement the lecture material and develop simple mathematical models used to predict evolutionary change in populations.

2. Instructor Information

Professor Graham J Thompson


e-mail: gthomp6@uwo.ca or graham.thompson@uwo.ca (both go to the same inbox)

The best way to make contact is just before or after class. I usually come to the room ahead of time and am free immediately after, so we can have brief exchanges as we need to without the need for a scheduled appointment. You are welcome to reach out via e-mail, say Hi in the hall, and I will be happy to respond and connect in that way. Otherwise, my office hours are by appointment. E-mail me if you have an issue.

3. Course Description, Learning Outcomes, Schedule, Delivery Mode

This course provides an overview of evolutionary processes. Our lectures will convey mostly conceptual ideas needed to understand this process, which is so often misunderstood and misrepresented, even in science. This emphasis on conceptual understanding may render this course different from others that you have taken in that it does not emphasize content (things to memorize). Instead, *Evolutionary Genetics* encourages a more fundamental understanding of the basic relationship between alleles, genotypes, phenotypes and the living environment. From these fundamentals, we will be able to complete simple exercises in the labs that allow you to explore the properties of these variables and the functional relationships among them.

Some of the topics we cover include: the historical origin and development of evolutionary ideas and the people to whom these ideas are attributed, the modern synthetic theory of evolution, measures of genetic variation, the Hardy-Weinberg model and how populations may deviate from it, natural selection, direct and indirect fitness, organizational complexity and the levels of selection,

major evolutionary transitions, synonymous and nonsynonymous mutations, genetic load, migration, drift, the coalescent, inbreeding and outbreeding, the neutral theory of molecular evolution, quantitative genetics, genetic effects, broad and narrow sense heritability and, finally, phylogeny and genomics.

For background that may be useful to match the assumed knowledge of the course, you may consult the following texts at your own will.

- Halliburton R 2004. Introduction to Population Genetics. Pearson/Prentice Hall.

An excellent textbook in population genetics. Covers most aspects presented in Biology 3466B.

- Nielsen R and Slatkin M 2013. An Introduction to Population Genetics, Theory and Applications. Sinauer.

A nice introduction to population genetics, with a palatable take on coalescent theory.

- Hedrick PW 2011. Genetics of Populations. Jones & Bartlett.

In its fourth Edition, this book is rich in examples taken from the primary literature. A great section on variation is nature.

- Falconer DS and Mackay TFC 1996. Introduction to Quantitative Genetics. Longman. The standard text on the inheritance of quantitative traits.

Has a very brief section on population genetics of discrete traits. An authoritative reference on quantitative genetics.

- Hartl DL and Clark AG 2007. Principles of Population Genetics. Sinauer.

The closest thing to a comprehensive textbook in the field. Some bits are hard to follow.

- Crow JF and Kimuar M 1970. An Introduction to Population Genetics Theory. Blackburn.

A classic in the field.

- Bergstrom CT and Dugatkin LA 2016. Evolution (2nd edition). Norton.

A great general text on Evolution. The population genetics sections are good.

- Bell, G 2008. Selection (2nd edition). Oxford.

Although not suitable as a text for this course, a must-read for anyone who wants a thorough understanding of selection as the driving principle of evolution.

- Bourke, A. F. G. 2011. Principles of Social Evolution. Oxford University Press.

This well-written softcover speaks well on the topic of kin theory and major evolutionary transitions.

The lecture content is grounded by a series of labs that are simple computer exercises requiring you to work your way through a guided tutorial to enter and analyse data, test straightforward predictions that sometimes require basic statistics, interpret your results to answer questions and, finally, present your effort and understanding by the **timely** hand-in of short lab reports that are each worth a small amount but add-up to substantial portion of your grade. *Please do not seek extensions on the lab report hand-ins.* The lecture material from the course draws from a textbook and from the labs.

Course-Level Learning Outcomes

As a result of actively viewing and thinking about the lectures, students should be able:

- To understand how allele frequencies change in living populations.
- To understand general rules that govern population-level change.
- To recognize the diagnostic features of populations that deviate from equilibrium.
- To appreciate the broader environmental context of microevolution.
- To recognize fitness consequences for genes, individuals, populations and species.
- To conceptualize evolutionary processes and relate these processes to the living world.

As a result of participating in on-line laboratory activities, students should be able:

- To recognize and measure genetic variation and genetic diversity.
- To generate and manage data spreadsheets.
- To choose and perform statistical analyses appropriate to the data at hand.
- To present and interpret results in written form using support from the primary literature.

Lab session schedule and information. Labs are assigned on Fridays, with TA-support on Tuesday and Wednesday (pick one), and the report is due the following Friday via the OWL Assignments tool. **Please do not ask for extensions.**

Dates	Details	Due date
January 8-12		No lab
January 15-19	Exercise #1: Getting acquainted with Excel and with the Hardy-Weinberg model	Jan 19th 2:30 pm
January 22-26	Exercise #2: Hardy-Weinberg Disequilibrium and the Wahlund effect	Jan 26th 2:30 pm
January 29-February 2		No lab
February 5-9	Exercise #3: Testing HW equilibrium in finite populations	Feb 9th 2:30 pm
February 12-16		No lab
February 19-23		No lab
February 26-March 1	Exercise #4: Demonstration of Fisher's Theorem with asexual organisms	Mar 1st 2:30 pm
March 4-8	Exercise #5: Multiple alleles, overdominance, adaptive landscapes and mutation	Mar 8th 2:30 pm
March 11-15		No lab
March 18-22	Exercise #6: Random genetic drift; Nonrandom mating and inbreeding	Mar 22nd 2:30 pm
April 1-5		No lab

Lab drop-ins	Day ¹	Time	Location	Teaching Assistant

¹ Drop-ins will be held during the six weeks that we have a lab exercise, as noted in the schedule above.

Teaching Assistants

Sarah Santos sdiasdos@uwo.ca
 Julia Lacika jlacika@uwo.ca

4. Course Materials

Required Texts

- *Molecular Population Genetics*, Matthew W. Hahn (2019 edition; Oxford University Press) Physical copies or a 180-day eBook option is available via The Book Store's online platform.

https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2023B&courses%5B0%5D=001_UW/BIO3466B

OWL

- Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class.

5. Methods of Evaluation

The overall course grade will be calculated as follows:

Assignments (6)	24%	Lab Reports, 4% each
Midterm Exam (7-9 pm)	32%	Thursday 15th February
Final Exam	44%	

Accommodated Evaluations

- **Midterm:** If students miss the Midterm for a Dean-approved reason their mark will be shifted to the Final Exam. If the scheduled midterm conflicts with another midterm that takes priority, then the student will write a make-up midterm that will be scheduled on a need-to basis. The re-scheduled midterm will be as close as possible to the original date, including, possibly, before the original date.
- **Lab Reports:** Make plans to hand-in reports on time. This is by far your best option. Handing in on time is good form and removes all doubt about penalties and saves everyone - you, me, your TA and your councilor - lots of emails and time. On-time hand-in also prevents any resentment that may arise about how your lateness is handled. Late reports will be deducted 10% up-front (i.e., at the exact deadline), with an additional 20% per day thereafter. Remember, there are only six labs, and there is lots of time to do them, provided you plan for it amongst your other responsibilities. Try to get it in, even if it is imperfect.

6. Student Absences

Absences from Final Examinations

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).

7. Accommodation and Accessibility

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>.

8. Academic Policies

The website for Registrarial Services is <http://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.

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.

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Professionalism & Privacy:

Western students are expected to follow the [Student Code of Conduct](#). Additionally, the following expectations and professional conduct apply to this course:

- Students are expected to follow online etiquette expectations provided on OWL
- All course materials created by the instructor(s) are copyrighted and cannot be sold/shared
- Recordings are not permitted (audio or video) without explicit permission
- Permitted recordings are not to be distributed
- Students will be expected to take an academic integrity pledge before some assessments
- All recorded sessions will remain within the course site or unlisted if streamed

9. Support Services

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.

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

10. Equity, Diversity, Inclusion and Decolonization (EDID):

Land Acknowledgement: We acknowledge that Western University is located on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak, and Chonnonton Nations, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous peoples (First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors of our society. Throughout Canada, North America, and the world, Indigenous Peoples are vital contributors to their communities, and we greatly value their presence, knowledge, and wisdom.