

Version 1.0 - subject to up-dates

1. Course Information

Evolutionary Genetics - Biology 3466B

The Winter 2022 edition of *Evolutionary Genetics* is expected to be a mix of on-line and in-person content. On-line lectures will be delivered in an asynchronous format, meaning that we won't all meet at once but rather I will post the course content to our OWL site where you can view it as you like. I will post lecture content twice per week, aiming for Mondays and Thursdays, as if we were following the course's normal in-person format. If in-person lecturing resumes, we will meet in class according to our normal schedule. The on-line version of the labs will likewise unfold each week as take-home exercises with on-line TA support. The labs complement the lecture material and develop simple mathematical models used to predict evolutionary change in populations.

List of Prerequisites

The prerequisite for this class is one of: Statistics for Science 2244A/B, Psychology 2810, Biology 2581A/B; or permission of the Department.

2. Instructor Information

Professor Graham J Thompson

Office: BGS 2068

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

For as long as we're on-line, you will see me as a talking head in our lectures :) This is slightly impersonal, I know. I will nonetheless hold occasional Zoom drop-in sessions to field questions regarding the course content. You are welcome to reach out, say Hi, and I will be happy to respond and connect in that way. Otherwise, my office hours are by appointment, and we would hold such meetings using our course OWL Zoom tool. Please use your Western (@uwo.ca) email address to contact me.

3. Course Syllabus, 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 in 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 but is often hard to follow.

- Roughgarden J 1996 (reprinted from 1979). Theory of Populations Genetics and Evolutionary Ecology. An Introduction. Prentice Hall.

Dated but still excellent. Integrates developments of current theory as of 1979. Deals reasonably well with both qualitative and quantitative inheritance.

- 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, this year, will be take-home 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. 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.

Dates	Details	Due date
January 10-14		No lab
January 17-21	Exercise #1: Getting acquainted with Excel and with the Hardy-Weinberg model	Jan 21st 2:30 pm
January 24-28	Exercise #2: Hardy-Weinberg Disequilibrium and the Wahlund effect	Jan 28th 2:30 pm
January 31- February 4	Exercise #3: Testing HW equilibrium in finite populations	Feb 4th 2:30 pm
February 7-11		No lab
February 14-18		No lab
February 21-25		No lab
February 28- March 4	Exercise #4: Demonstration of Fisher's Theorem with asexual organisms	Mar 4th 2:30 pm
March 7-11	Exercise #5: Multiple alleles, overdominance, adaptive landscapes and mutation	Mar 11th 2:30 pm
March 14-18	Exercise #6: Random genetic drift; Nonrandom mating and inbreeding	Mar 18th 2:30 pm
March 21-25		No lab
March 28-April 1		No lab

Lab drop-ins	Day ¹	Time	Teaching Assistant
Session 1	Tuesday	1:30-3:30	Anna, Matheus
Session 2	Wednesday	2:30-4:30	Anna, Matheus

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

Teaching Assistants

Anna Chernyshova achernys@uwo.ca
 Matheus Lima msanital@uwo.ca

4. Course Materials

Required Texts

- *Molecular Population Genetics*, Matthew W. Hahn (2019 edition; Oxford University Press) Physical or eBook textbooks are available via The Book Store's online platform.

https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2021B&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.

Technical Requirements

- To participate in this on-line edition course, you will need a stable internet connection, a computer with working microphone and/or webcam, and possibly other basic computer or software needs.

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 17th 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, 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:** If you self-report a lab exercise or are otherwise accommodated by the Academic Counselling Office, you will simply hand-in your report 48 hours later than normal (without penalty). 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.

6. Student Absences

- **Academic Consideration for Student Absences**

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

- **Academic Consideration for Student Absence**

Students will have up to two opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade

If the conditions for a Self-Reported Absence are not met, students will need to provide a Student Medical Certificate if the absence is medical or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

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

and for the Student Medical Certificate (SMC), see:

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

7. Academic Policies

The website for the Registrar is <http://www.registrar.uwo.ca>.

- In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, 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 his/her official university address is attended to in a timely manner.
- **Electronic devices** Some calculations will be asked of you on the Midterm and Final. It is therefore permissible to use a calculator.

- **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.

8. 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/>.

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 (519) 661-2147 if you have any questions regarding accommodations.