

Faculty of Science Course Syllabus
Department of Biology
BIOL 3044
Ecological Genetics
Winter 2023

Instructor: Dr. Robert Latta Robert.Latta@Dal.ca Office Hrs TBA or by Appointment

To contact me please use my email address given above, (rather than going through Brightspace). Please use your Dalhousie Email account, and an informative and relevant subject line. Since I teach multiple classes, please tell me what course you are taking.

Lectures: MWF, 12:30-13:30 LSC Rm C208

Course Delivery: In person (synchronous)

- As per university guidelines, you are required to wear masks when participating in in-person activities, and you should continue to follow good public health practices. Public health guidelines surrounding COVID-19 are outlined at <https://novascotia.ca/coronavirus/symptoms-and-testing/>. Dalhousie COVID-19 information and updates: <https://www.dal.ca/covid-19-information-and-updates.html>
- Students experiencing symptoms of COVID-19 or flu should self-isolate. To accommodate any students who may need to miss class due to illness,
- Video Lectures (from Winter 2021) will also be posted on Brightspace. However, these are intended to serve as a backup, rather than a substitute for in person lectures.

Course Description

An advanced examination of genetic variation in ecologically important (especially quantitative) traits. Topics will include determining whether a trait is inherited; natural selection in the wild; specialist vs. generalist strategies; how variation is maintained in the face of selection; trade-offs between competing selective pressures and selection for diversification.

Course Prerequisites: BIOL 2040.03 or BIOL 3041.03

Course Prerequisites: BIOL 4044.03

Course Objectives/Learning Outcomes

- 1 Predict the mean and variance of a quantitative trait from allelic frequencies and effects.
- 2 Explain the principle of QTL mapping and apply it to single locus analysis.
- 3 Infer (calculate) genetic variance components for continuous traits from any of the major methods used to infer them (One way ANOVA, covariance among relatives, realized heritability)
- 4 Perform a one-way ANOVA
- 5 Design experiments to quantify genetic variance and heritability,
- 6 Recognize faulty experimental designs and diagnose.
- 7 Apply the breeders equation in its simple form to any set of observations (ie calculate any of the values given the others).
- 8 Describe the extension of the breeder's equation to multiple correlated characters.



- 9 Use fitness functions (the correlation between ecological traits and fitness) to describe selection and predict responses.
- 10 Relate genetic covariances to trade-offs between competing selection pressures (e.g. for more vs larger eggs).
- 11 Explain how genetic correlations and tradeoffs arise and interpret empirical evidence.
- 12 Extend the concept of trade-offs to local adaptation and the evolution of specialists and generalists (and, as always, interpret evidence)
- 13 Define/recognize genotype by environment interactions,
- 14 Interpret reaction norms and
- 15 Distinguish between the application of GxE to local adaptation vs phenotypic plasticity.
- 16 Predict/interpret the outcome of a hybrid cross (inter or intraspecific) for the early generation hybrids (F1, F2, BC) in terms of additive, dominance and epistatic interactions.
- 17 Predict ecological outcomes of hybridization.

Course Materials

Textbook

Jeffrey K. Conner and Daniel L. Hartl. A Primer of Ecological Genetics. Sinauer, 2004

- Available at the Dalhousie Bookstore. We will use this book as a reference. Additional readings may be assigned from time to time. These will be made available online via links on the course web site.

Course website: <https://dal.brightspace.com/>

Or from your usual myDal Login (Quicklink in upper right)

- o Log in via netID, and navigate to the webpage for this course.
- o I will be using the Brightspace web server to post lecture slides/videos, assignments, and other communications, announcements, etc.

Course Assessment

Component	Weight (% of final grade)	Date
Tests/quizzes		
Midterm	30%	(Wednesday, March 1, 2023, 12:30-13:30)
Final exam	40%	(Scheduled by Registrar, April 13-25)
Assignments		
Problem sets(8)	30%	Weekly
<ul style="list-style-type: none"> ▪ Posted online Wednesday (Jan 18, 25, Feb 1,8, March 8, 15, 22, 29) <ul style="list-style-type: none"> • <i>Italicized dates on class schedule</i> ▪ <u>Due the following Monday 4pm</u> ▪ graded by Wednesday and handed back with the next assignment. ▪ worth 30% of your final Grade (3.75% each) 		

These short assignments will be designed to build upon one another. The idea is to have you work through some of the concepts used to analyze the genetics of continuously varying traits. These are a set of skills that are not inherently difficult, but that do require hands-on practice.

The assignments are designed for quick turn-around from one assignment to another. The assignments will be short, involving only two questions each. However, you will only have five days to complete each assignment, so it is important that you budget some time each week to work on them. In return, I promise to grade the assignments quickly and have them handed back in the next lecture.

As the semester progresses, the assignment topics will shift from calculation oriented to writing (\approx 1-2 page) oriented.

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)		

Final numerical grades will be rounded to the nearest integer prior to conversion to the Dalhousie Common Grade Scale. No 'bumping-up' will be applied. For example, 79.48% rounds to 79% and will be awarded a B+.

Course Policies on Missed or Late Academic Requirements

Assignments

- 1 I will **consider** accepting late assignments without penalty **provided** you have a reasonable cause and make arrangements before 6 pm on the day previous to the due date. It is your responsibility to contact me by email to make these arrangements. Otherwise:
- 2 Late assignments will have the grade reduced by 10% per day if the above arrangements have not been made.
- 3 Late assignments cannot be accepted after the answers have been posted and the corrected assignments returned.

The Mid-term exam will be held in person during regular class time, and therefore I expect all students to be able to write the exam at the scheduled time. If you must miss the exam for a valid reason (see below), you must contact me on or before the day of the mid term by email, indicating that you have missed the test and why. Any makeup exam may be scheduled at the professor's discretion, and students who miss the midterm for a valid reason and are also unable to attend such a makeup will have the final exam pro-rated

- o Reasonable reasons for missing a test are: Illness, death in the family, severe storm days. etc.
- o Reasonable reasons do NOT include: Having another mid-term the same day, extended spring break travel plans, minor traffic disruptions etc.

The Final Exam will be scheduled by the Registrar's Office during the formal Exam Period (April 13-25). The specific date will be announced by the Registrar sometime during the semester. It is therefore important that all students be available throughout the formal exam period.

Course Policies related to Academic Integrity

Assignments are NOT collaborative. Students must submit their own work for each assignment.

Multiple versions of some assignments will be set, and students must do their assigned version. Assignments have been modified from previous years, so that previous year's answer keys will not apply.

All Dalhousie policies on Academic integrity will apply.

Course Content

Date	General Topic	<i>Approx</i> Lecture Topics	Reading
Jan 9 Jan 11 Jan 13	Single Gene selection vs Neutrality	Introduction Single Genes Mean and Variance of Traits	Review Chap 3
Jan 16 <i>Jan 18</i> Jan 20	Genes and Quantitative Traits	Genes and Traits Genes "For" Traits Quantitative Trait Loci	97-112 170-180,
Jan 23 <i>Jan 25</i> Jan 27	Heritability	Response to Selection Correlation among Relatives ANOVA	112-133
Jan 30 <i>Feb 1</i> Feb 3	Finishing Heritability Starting Selection	Finishing ANOVA Understanding Heritability <i>Munro Day – No Class</i>	163-170, 189-199
Feb 6 <i>Feb 8</i> Feb 10	Quantitative Trait Selection	Natural Selection in the Wild Fitness Functions Fitness Surfaces	150-163
Feb 13 Feb 15 Feb 17	Evolution in Multiple Traits	Correlated Traits Adapting in Multiple Dimensions How does adaptation proceed?	199-224
Feb 20-24	Reading Week	No Class	
Feb 27 <i>Mar 1</i> Mar 3	Reserve Days and MIDTERM	Reserve Class (for catch-up) MIDTERM February 16 Mutation-Selection Balance	
Mar 6 <i>Mar 8</i> Mar 10	Life History and Trade-offs	Fitness Components Size-Number Trade-off Evolution of Reproduction and Ageing	79-80
Mar 13 <i>Mar 15</i> Mar 17	Specialists and Generalists	Negative Genetic Correlations Local Adaptation Genotype by Environment Interactions	
Mar 20 <i>Mar 22</i> Mar 24	Specialists and Generalists	Reaction Norms Plasticity and Homeostasis Adaptation vs Extinction	138-150
Mar 27 <i>Mar 29</i> Mar 31	Hybridization	Hybridization - Theory Dominance - Inbreeding Depression	
April 3 April 5 April 7	Inbreeding and Outbreeding	Epistasis - Outbreeding Depression Recombination and New Environments <i>Good Friday – No Class</i>	
April 10 April 11		Catch Up And Review	

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://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loadusercredits=False>

University Grading Practices

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

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/undergrad-students/degree-planning.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.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>