



## 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)

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

## Course Assessment

Component	Weight (% of final grade)	Date
<b>Tests/quizzes</b>		
Midterm	30%	(Wednesday, February 28, 2023, 13:30-14:30)
<b>Final exam</b>	40%	(Scheduled by Registrar, April 11-23)
<b>Assignments</b>		
Problem sets(8)	30%	Weekly
<ul style="list-style-type: none"> <li>▪ Posted online Wednesday (Jan 17, 24, 31, Feb 7, March 6, 13, 20, 27) <ul style="list-style-type: none"> <li>• <i>Italicized dates on class schedule</i></li> </ul> </li> <li>▪ <u>Due the following Monday 6pm</u></li> <li>▪ graded by Wednesday and handed back with the next assignment.</li> <li>▪ worth 30% of your final Grade (3.75% each)</li> </ul>		

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, typically two days after the due date.

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

- Please note that any makeup exam that may be provided is intended as an accommodation to students who were unable to write the test on the scheduled day. It is not to be viewed an alternative "option" that may be "chosen" for the student's convenience.
- Reasonable reasons for missing a test are: Illness (on the day of the test), death in the family, severe storm days. etc.
- Reasonable reasons do NOT include: Having another mid-term the same day, extended spring break travel plans, being ill prior to the test, minor traffic disruptions etc.

The Final Exam will be scheduled by the Registrar's Office during the formal Exam Period (April 11-23). 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 8 Jan 10 Jan 12	Single Gene selection vs Neutrality	Introduction Single Genes Mean and Variance of Traits	Review Chap 3
Jan 15 <i>Jan 17</i> Jan 19	Genes and Quantitative Traits	Genes and Traits Genes "For" Traits Quantitative Trait Loci	97-112 170-180,
Jan 22 <i>Jan 24</i> Jan 26	Heritability	Response to Selection Correlation among Relatives ANOVA	112-133
Jan 29 <i>Jan 31</i> Feb 2	Finishing Heritability Starting Selection	Finishing ANOVA Understanding Heritability <i>Munro Day – No Class</i>	163-170, 189-199
Feb 5 <i>Feb 7</i> Feb 9	Quantitative Trait Selection	Natural Selection in the Wild Fitness Functions Fitness Surfaces	150-163
Feb 12 Feb 14 Feb 16	Evolution in Multiple Traits	Correlated Traits Adapting in Multiple Dimensions How does adaptation proceed?	199-224
Feb 19-23	Reading Week	No Class	
Feb 26 <i>Feb 28</i> Mar 1	Reserve Days and MIDTERM	Reserve Class (for catch-up) MIDTERM February 16 Mutation-Selection Balance	
Mar 4 <i>Mar 6</i> Mar 8	Life History and Trade-offs	Fitness Components Size-Number Trade-off Evolution of Reproduction and Ageing	79-80
Mar 11 <i>Mar 13</i> Mar 15	Specialists and Generalists	Negative Genetic Correlations Local Adaptation Genotype by Environment Interactions	
Mar 18 <i>Mar 20</i> Mar 22	Specialists and Generalists	Reaction Norms Plasticity and Homeostasis Adaptation vs Extinction	138-150
Mar 25 <i>Mar 27</i> Mar 29	Hybridization	Hybridization - Theory Dominance - Inbreeding Depression	
April 1 April 3 April 5	Inbreeding and Outbreeding	Epistasis - Outbreeding Depression Recombination and New Environments <i>Good Friday – No Class</i>	
April 8 April 9		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](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](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](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](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](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](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](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](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](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](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](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](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](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>