

Faculty of Science Course Syllabus
Department of Biology
BIOL 3042/MARI 3042
Molecular Ecology
Fall 2019

Instructor(s): Daniel Ruzzante	daniel.ruzzante@dal.ca	LSC 4045
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Lectures: 10:05-11:25 Tue/Thu *Location* LSC-COMMON AREA C208

Laboratories: 0

Tutorials: 0

Submit course syllabus to your Depart office for posting on the Dept website prior to the start of term
Submit requests for final exam exemptions to the Dean's office at least 2 weeks prior to the start of term

Course Description

We survey techniques of molecular genetic analysis and consider how they can be used to identify species, populations, sexes, individuals and family relationships, and study population attributes such as historical dispersal, contemporary connectivity, mating behaviour and effective population size. Evaluation is based on assignments, a test and a final exam.

Course Prerequisites

A grade of B- or better in each of [BIOL 2030.03](#) (or [GENE 2000.03](#)), [BIOL 2040.03](#), and [BIOL 2060.03](#).

Course Objectives/Learning Outcomes

Understand main concepts in population genetics (Hardy-Weinberg Equilibrium, genetic drift, effective population size, inbreeding depression)

Familiarity with molecular markers and methods used in population genetics, molecular ecology, phylogeography, landscape genomics.

Familiarity with applications of molecular ecology, such as wildlife forensics, conservation biology and invasive species.

Course Materials

- *No required text*

DATE	LECT #	INST	TOPIC	Quizzes	Assignments
Tues Sep 3	Lect 1	PB	Course intro, what is Mol Ecol, reasons for studying genetic variation		
Thurs Sep 5	Lect 2	PB	Genetic markers : allozymes; begin lab methods - PCR-Sanger sequencing		
Tues Sep 10	Lect 3	PB	lab methods: isothermal amplification; Genetic markers: microsatellites	Quiz	
Thurs Sep 12	Lect 4	PB	Genetic markers: finish microsatellites, minisatellites, begin mtDNA		
Tues Sep 17	Lect 5	DR	Population subdivision, F-statistics & gene flow	Quiz	
Thurs Sep 19	Lect 6	DR	Population subdivision: Model based clustering		
Tues Sep 24	Lect 7	DR	Neutral Evolution: HWE, drift, effective pop size	Quiz	Assign 1 intro
Thurs Sep 26	Lect 8	DR	Neutral Evolution: HWE, drift, effective pop size		
Tues Oct 1	Lect 9	DR	Inbreeding, inbreeding depression, purging	Quiz	Assign 1 due
Thurs Oct 3	Lect 10	DR	Inbreeding, population fragmentation, demography		Assign 2 intro
Tues Oct 8	Lect 11	DR	Landscape genetics - case studies	Quiz	
Thurs Oct 10	Lect 12		no class - prepare for midterm		Assign 2 due
Tues Oct 15	Lect 13		MIDTERM		
Thurs Oct 17	Lect 14	PB	genetic markers: mtDNA (1)		Assign 3 intro
Tues Oct 22	Lect 15	PB	genetic markers: mtDNA (2); phylogenetic analysis		
Thurs Oct 24	Lect 16	PB	Phylogenetic analysis (2), barcoding and study of biodiversity	Quiz	
Tues Oct 29	Lect 17	PB	Phylogeography: bridge between phylogenetics and population genetics		
Thurs Oct 31	Lect 18	PB	Phylogeography (2)	Quiz	Assign 3 due
Tues Nov 5	Lect 19	PB	Next Generation DNA sequencing, metagenomics		Assign 4 intro
Thurs Nov 7	Lect 20	PB	The evolution of molecular ecology methods: from allozymes to SNPs & RAD	Quiz	
Tues Nov 12	no lect		reading week		
Thurs Nov 14	no lect		reading week		
Tues Nov 19	Lect 21	DR	Forensics and management	Quiz	
Thurs Nov 21	Lect 22	DR	Conservation Breeding and restoration		Assign 4 due - Assign 5 intro
Tues Nov 26	Lect 23	DR	Invasive species	Quiz	
Thurs Nov 28	Lect 24	DR	Putting it all together: genetic management of fragmented populations		Assign 5 due; essay due grad students
Tues Dec 3			No classes		

Course Assessment

Assignments	UG	G
microsatellite primer design	5%	4%
basic population genetics (Genalex)	5%	4%
Effective Population size	10%	8%
Structure	10%	8%
Sequence analysis	10%	8%
5 assignments	40%	32%
Quizzes (10)	10%	10%
1 MIDTERM	15%	13%
FINAL EXAM	35%	25%
Essay		20%
PRESENTATIONS		6%
	100%	100%

Other course requirements

N/A

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)		

Course Policies

Late assignments are penalized at a rate of 10% per day.
Missed exams will require a doctor's note.

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Course Content

- What is Molecular Ecology, reasons for studying genetic variation
- Genetic markers : allozymes; begin lab methods - PCR
- Neutral Evolution: HWE, drift, effective pop size
- Lab methods: quantitative & reverse transcription PCR, DNA sequencing
- Genetic markers: microsatellites
- Population subdivision, F-statistics & gene flow
- Population subdivision: Model based clustering
- Inbreeding, inbreeding depression, purging
- Inbreeding, population fragmentation, demography
- Local Adaptation Q_{st}/F_{st}
- genetic markers: mtDNA, phylogenetic analysis
- Barcoding and study of biodiversity
- Phylogeography: bridge between phylogenetics and population genetics
- Landscape genetics, case studies
- Forensics and management
- Case studies
- Next Generation DNA sequencing, metagenomics
- The evolution of molecular ecology methods: from allozymes to SNPs & RAD
- Invasive species
- Conservation Breeding and restoration

Prerequisites

A grade of B- or better in each of BIOL 2030.03 (or GENE 2000.03), BIOL 2040.03, and BIOL 2060.03.

Faculty of Science Course Syllabus (Section B) (revised June-2018)

Molecular Ecology BIOL/MARI 3042

Please ensure that the following information on University Policies and Student Resources is available to all students in your course. This document may be posted on your Brightspace course site, or elements may be copied into your **Course Syllabus, Section A**.

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://www.dal.ca/academics/important_dates.html

University Grading Practices

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

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.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/academic-advising.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/services-support/student-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>