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
Paul Bentzen paul.bentzen@dal.ca LSC 6052

Lectures: 10:05-11:25 Tue/Thu Location LSC-COMMON AREA C208
Laboratories: 0
Tutorials: 0

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

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

**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.

**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 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 Qst/Fst
- 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.


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

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