BIOL 2018 3 ch (1C 3L) Winter 2019
Laboratory in Evolutionary Genetics

Instructors Adrian Reyes Prieto. Bailey Hall 269, areyes@unb.ca
Jason Addison. Bailey Hall 211, ja.addison@gmail.com
René Malenfant. Bailey Hall 111, rene.malenfant@unb.ca

Scientific Technician Christine Wile. Bailey Hall 133b, cwile@unb.ca

Teaching Assistants Cody Brooks, Taylor Burke, Alexandra DeShaw, Daniel Hanscom, Tyler Lynn, Lauren Miller, Rachael Wyatt

Sessions

Mondays	2:30 PM - 5:20 PM, Bailey Hall 134 & 108
Tuesdays	2:30 PM - 5:20 PM, Bailey Hall 134 & 108
Wednesdays	2:30 PM - 5:20 PM, Bailey Hall 134 & 108
Fridays (pre-lab)	11:30 AM - 12:20 PM, Bailey Hall 146

Co-requisite **BIOL 2013 Evolutionary Genetics**

Pre-requisites

BIOL 1001	Biological Principles, Part I
BIOL 1006	Applications in Biology, Part I
BIOL 1012	Biological Principles, Part II
BIOL 1017	Applications in Biology, Part II

Table of contents

1. Overview

This lab course is a companion to BIOL 2013 *Evolutionary Genetics*. The course will instruct you in the use of laboratory experiments and computer analyses to investigate core concepts in evolutionary genetics.

2. Laboratory sections organization

Students in each of the three lab sections (1=Monday, 2=Tuesday, 3=Wednesday) will be divided in alphabetical order into two subsections A and B to attend alternately **"dry" or "wet" labs every second week**. In other words, in a given week, the first subsection (**e.g. 1A**) attends "wet" lab (Bailey Hall 134) whereas the second subsection (**e.g. 1B**) attends "dry" lab (Bailey Hall 108). Then, the following week, lab activities for each subsection will be inverted. Lab subsections will be assigned during the first pre-lab talk (January 8th). Labs start the week of January 15th and, for just this week, students will have both a wet and a dry lab, about 80 minutes each. A lab calendar is posted on D2L.

Wet labs will comprise learning fruit fly (a popular animal model for evolutionary genetics studies) handling; fruit fly marking and capture protocols; use of basic molecular biology techniques for genetic analyses; documentation of obtained results and elaboration of a high-quality lab notebook. **Dry labs** will be focused on basics of experimental design and introduction to statistical analysis; learning the use of both Microsoft Excel for exploring and manipulating numerical data and the scripted programming language R for statistical analysis and plotting. Simulations will also be used to enhance student understanding.

3. Expected outcomes

The aim of this lab course is to provide you with an opportunity to **plan, conduct and analyse your own scientific study** to answer a scientific question. In addition, by the end of this exercise you should have experience with molecular biology laboratory techniques, handling and analysing your own data, and writing a manuscript that explains the motivation for the study, describes its results, and provides a biological interpretation. You will also have an enhanced understanding of key concepts in ecology and evolution, and genetics, including measurement of population size using the tools of mark–recapture and analysis of standing genetic variation.

To provide you with a learning opportunity to develop skills in group management and negotiation (and to make things easier for us), we ask that you work in groups of three or four. The experimental design will be largely the same among the groups.

To provide you time to plan your experiment and to learn data handling and analysis and to experiment with simulations that will enhance your understanding of your project, every second week will be a **dry lab**. Use this time to plan what happens in the **wet lab**, and when you have some data, analyse it.

To help you work through your project we will provide "**primers**" on experimental design, data handling in Excel and conducting statistical analyses in the R statistical language. The Internet is a very big place and we encourage you to use it. **We have also provided standard protocols for using mark–recapture to estimate census population size (N_c) and using molecular data to estimate effective population size (N_e)**. These techniques have been optimised and so are safest to use. Other valuable sources of information are the suggested textbooks.

4. The research question

How do estimates of population size of *Drosophila melanogaster* differ based on census versus molecular methods?

We will be using two very different approaches to estimate the size of a population of *Drosophila melanogaster* that has been maintained in Bailey Hall lab facilities (room 133) for three years. The census method uses the principles of mark–recapture to estimate how many individuals are in the *D. melanogaster* population of room 133. The molecular method estimates the *effective* population size by measuring standing genetic variation. This will be done by estimating heterozygosity using RAPD markers (RAPD = random amplification of polymorphic DNA). The details of how we will use these two approaches will be provided in class and in various documents as we proceed through the term.

5. Suggested textbooks

***Evolutionary Analysis* (5th Edition)** by **S. Freeman and J.C. Herron.** The textbook is edited by **Pearson-Benjamin Cummins (ISBN-13: 978-0321616678)** and will be available at the UNB bookstore. The 4th edition of the book **(ISBN 978-0132275842)** works is adequate as well. Copies of the textbook will be available on reserve in the Science Library.

***The Analysis of Biological Data* (2nd Edition)** by **M.C. Whitlock and D. Schluter**. The book is edited by **Roberts and Company Publishers** (**ISBN-13: 978-0981519401**). Copies are available on reserve in the Science Library.

***A Short Guide to Writing about Biology* (9th Edition)** by Jan Pechenick. This book is edited by **Pearson** (**ISBN-13: 978-0321984258**).

6. Assessments and grading scheme

Throughout the course we will have various skills assessment exercises to keep you on track and to make sure you progress to the next stage.

Summary of assessment elements

- Seven lab evaluations	35%
- Two lab notebook checks	10%
- Lab exam	30%
- Final written report	25%
Total	**100%**

Minimum course requirements to complete the course.

- 100% of the lab evaluations
- Pass the final proficiency test
- Complete the final written report
- Completion of a lab notebook

Note: If you miss a lab, for any reason, you must complete a **Statement of Absence** form (section 9 of this document), sign it and handing it to the instructor on charge. The **Statement of Absence** form must be handed in within 7 days of your return to classes.

6.1. Skills and knowledge to be evaluated

6.1.2. Seven lab proficiency evaluations 35%

The seven lab proficiency evaluations are:

Proficiency evaluation #1 (5%; January 14)
Wet lab: Complete lab proficiency test (pipetting, solutions)

Proficiency evaluation #2 (5%; January 14)
Dry lab: Experimental design quiz

Proficiency evaluation #3 (5%; January 21)
Wet lab: Finish the "Learn to fly" activities

Proficiency evaluation #4 (5%; starting January 21)
Dry lab: Conduct mark–recapture simulations and report on them

Proficiency evaluation #5 (5%; starting February 4)
Dry lab: Conduct effective population size simulations and report on them

Proficiency evaluation #6 (5%; starting February 25)
Dry lab: Complete a data organization and analysis tutorial for Microsoft Excel and R

Proficiency evaluation #7 (5%; starting March 18)
Dry lab: Complete the statistical analysis for your own data. (Or using data collected from previous years.)

6.1.3. Elaboration of a lab notebook 10%

Maintaining an organized and informative lab notebook is critical to the scientific process and thus an important skill to learn. You will be given both written and verbal guidance throughout your laboratory sessions, and there will be in-lab assessments of your notebooks beginning the weeks of Feb 25th and March 18th (5% each).

6.1.4. Final lab exam 30%

The course ends with a final lab exam (Apr. 8 to Apr. 10). This will test the skills you have learnt during your semester. Can you sex flies? Can you do the calculations to make solutions? Do you know what stats test to use? Can you come up with a good experimental design? Can you interpret graphs/statistical tables?

6.1.5. Final written report 25%

Effectively communicating your research is fundamental to the process of science. The final report for the lab will include sections describing the methods and results, and a short discussion describing your biological interpretation of your findings. Both verbal and written guidance will be provided throughout the semester. The final report is due on the last day of classes (Apr. 11).

6.2 Grading scheme

Score (%)	Grade	Score (%)	Grade	Score (%)	Grade
100-93	A+	75-79	B+	60-64	C+
85-92	A	70-74	B	55-59	C
80-84	A-	65-69	B-	50-54	D
				<50	F

7. General policies

Use of electronic devices

Computers and tablets
Feel free to bring your laptops or tablets to the lectures and labs, but only use these in a manner that will not disturb those around you. Please refrain from using your laptops for anything other than taking notes, entering data or working on figures/tables/text for projects.

Calculators
Use of calculators on quizzes, midterms, and exams is permitted and encouraged.

Mobile phones and similar devices
Phones must be turned off and remain off for the duration of lectures/labs. If required phone's camera can be used for data documentation (e.g., photographs, movies)

Listening to music while working individually is permitted as long as it does not become distracting. Text messaging during lab work is prohibited.

Academic Integrity

Cheating during exams and plagiarism, **particularly copying written assignments**, won't be tolerated.
Conducts considered as plagiarism are:

1. Quoting verbatim or almost verbatim from a source (such as copyrighted material, notes, letters, business entries, computer materials, etc.) without acknowledgment.
2. Adopting someone else's line of thought, argument, arrangement, or supporting evidence (such as, for example, statistics, bibliographies, etc.) without indicating such dependence.
3. Submitting someone else's work, in whatever form without acknowledgment.
4. Knowingly representing as one's own work any idea of another.

For more detail please refer to 6 and read carefully UNB regulations and definitions regarding plagiarism at http://go.unb.ca/tlsPb0XX5. It is the student's responsibility to know the regulations.

8. Helpful on-campus resources

Writing and Study Skills Support

UNB's Student Services provides many coaching and mentoring services to assist with writing papers, effective study methods, and other skills development related to student success: http://www.unb.ca/fredericton/studentservices/academics/writing-centre/index.html

Science Library Support

UNB's Science library offers assistance to students with respect to research and information literacy: http://lib.unb.ca/about/science.php

In addition, UNB libraries offer several Student Success Workshops throughout the term: http://www.unb.ca/fredericton/studentservices/studentsuccessseries.html

Math Skills Support

UNB's Math Learning Centre offers math help drop-in times and opportunity to book appointments: http://www.math.unb.ca/~mathhelp/

Technical Support

Information Technology Services (ITS) Help Desk can be reached by phone 457-2222, email - itservicedesk@unb.ca, or visited in person at the Harriet Irving Library Learning Commons. http://www.unb.ca/its/get-it-help.html

Academic Advising:

For academic advising information and assistance, see: www.unb.ca/student-toolkit

9. Statement of Absence

Department of Biology
University of New Brunswick
10 Bailey Drive
Fredericton, NB
E3B 5A3
Phone: (506) 453-4583

STATEMENT OF ABSENCE

TO BE COMPLETED BY THE STUDENT

If you miss a lab, for any reason, please complete this form and *sign it upon handing it to the course instructor*. It must be handed in within 7 days of your return to classes.

Contact Information (please print)

Last Name	First Name	Middle Name	Student Number
Address		City	Postal Code
Telephone/Cell	Faculty		UNB email

Lab information

Course name, number & section (e.g., Biology 1006, Thursday morning)	Date and name of missed lab experiment

Reason for missed lab (please print)

Please briefly identify the reason for missing a lab (e.g., ill, death in family. Details are not necessary). You must include supporting documentation, such as a signed note from your residence don, your parents or your roommate, also stating the reason for your absence from the lab. A doctor's note is not necessary, but will certainly be accepted. Please staple supporting documentation to this form.

Student's Statement:

I certify that I was incapacitated on the date(s) given above and did not complete the lab experiment(s) listed above. I recognize that falsification of documentation or misrepresentation constitutes academic dishonesty and can result in disciplinary charges.
I understand that it is my responsibility within seven calendar days of my return to campus, to sign this form with the instructor of the lab course listed above.

Student's Signature	Date (dd/mm/yyyy)

10. Calendar

Note: Dates are tentative and modifications are possible. Check the dates of wet and dry labs for each of the six subsections: 1A, 1B, 2A, 2B, 3A, and 3B.

Date	BIOL 2018 Pre-lab talk Bailey Hall 146	DRY LAB Bailey Hall 108	WET LABS Bailey Hall 134	Assessments DRY	Assessments WET
Monday, January 7, 2019		No Labs (First Week)			
Tuesday, January 8, 2019					
Thursday, January 10, 2019					
Friday, January 11, 2019	**Introduction; working with *Drosophila***				
Monday, January 14, 2019		Experimental design (A/B)	Working with *Drosophila* (B/A)	Quiz (5%)	Pipetting, solutions (5%)
Tuesday, January 15, 2019					
Wednesday, January 16, 2019					
Friday, January 18, 2019	**Mark-recapture**				
Monday, January 21, 2019		Mark-recapture simulations (A)	Mark-recapture of flies (B)	Mark-recapture simulation (5%)	"Learn to fly" (5%)
Tuesday, January 22, 2019					
Wednesday, January 23, 2019					
Friday, January 25, 2019	**Effective population size (Ne), genetic drift, and heterozygosity**				
Monday, January 28, 2019		Mark-recapture simulations (B)	Mark-recapture of flies (A)		
Tuesday, January 29, 2019					
Wednesday, January 30, 2019					
Friday, February 1, 2019	**DNA extraction protocol**				
Monday, February 4, 2019		Effective population size simulations (A)	DNA extraction (B)	Ne simulations (5%)	
Tuesday, February 5, 2019					
Wednesday, February 6, 2019					
Friday, February 8, 2019					
Monday, February 11, 2019		Effective population size simulations (B)	DNA extraction (A)		
Tuesday, February 12, 2019					
Wednesday, February 13, 2019					
Friday, February 15, 2019					
Monday, February 18, 2019		No Labs (Week of Family Day)			
Tuesday, February 19, 2019					
Wednesday, February 20, 2019					
Friday, February 22, 2019	**Introduction to R and RAPDs (i.e., PCR, primers)**				
Monday, February 25, 2019		Excel & R #1 (A)	PCR (B)	Excel and R #1 (5%)	
Tuesday, February 26, 2019					
Wednesday, February 27, 2019					
Friday, March 1, 2019					
Monday, March 4, 2019		No Labs (Winter Break)			
Tuesday, March 5, 2019					
Wednesday, March 6, 2019					
Friday, March 8, 2019					
Monday, March 11, 2019		Excel & R #1 (B)	PCR (A)		
Tuesday, March 12, 2019					
Wednesday, March 13, 2019					
Friday, March 15, 2019	**RAPDs: gel electrophoresis, band scoring, and Ne calculations**				
Monday, March 18, 2019		Excel & R #2 (A)	Run agarose gels and score RAPDs (B)	Excel and R #2 (5%)	
Tuesday, March 19, 2019					
Wednesday, March 20, 2019					
Friday, March 22, 2019					
Monday, March 25, 2019		Excel & R #2 (B)	Run agarose gels and score RAPDs (A)		
Tuesday, March 26, 2019					
Wednesday, March 27, 2019					
Friday, March 29, 2019	**Final report information**				
Monday, April 1, 2019		Final report help session (A/B)	Final report help session (B/A)		
Tuesday, April 2, 2019					
Wednesday, April 3, 2019					
Friday, April 5, 2019	**Lab exam information**				
Monday, April 8, 2019		Lab exam (A)	Lab exam (B)		
Tuesday, April 9, 2019					
Wednesday, April 10, 2019					
Thursday, April 11, 2019		LAST DAY OF CLASS (FINAL REPORT DUE AT 11:59 PM)			

11. Frequently asked questions

What should I wear in lab? What should I bring to each lab?

Lab coats are required. Students should come to lab each week with everything they need to complete the lab. Any special requirements will be announced in the Monday pre-lab lecture.

How should I prepare myself for each week's lab session?

Attendance at the Monday pre-lab lecture is mandatory. Lectures are intended to cover the background and rationale for each week's lab. As well, there may be important instructions given pertaining to each week's lab.

UNB Attendance Policy:
http://www.unb.ca/academics/calendar/undergraduate/current/regulations/universitywideacademicregulations/i-generalcourseregulation/a.classattendance.html

Is lab attendance mandatory?

Yes, lab attendance is mandatory. Should you miss a lab, you will forfeit the marks assigned for that week's lab. Exceptions to this rule will be made only for legitimate reasons such as illness or on compassionate grounds.

If I miss a lab for legitimate reasons, can I "make up" the lab I missed?

No makeup labs will be offered. In some cases, you may request permission to attend an alternate lab session in the same week. However, you will be accommodated only if there is room for you. For students who miss labs for legitimate reasons (see above) and who are not able to attend another lab section in the same week, the missed lab marks will be pro-rated.

Important: Absence from any lab does not exempt students from responsibility for material covered in those labs. The onus is on the student to get this information from colleagues who were in attendance.

What is expected of me in each lab? Do I have to hand anything in?

Most weeks, you should expect to either hand in an assignment and/or be conducting preparations for the specified projects. For lab assignments, you will take the information (collected data) obtained in the lab and transform it into 'results'. The process will involve reworking and expanding the information into a more presentable form. In most cases, you will be expected to submit these for marking at the beginning of your next lab period.

Are there penalties for late assignments or reports?

Yes. Late submissions (lab assignments or project reports) will be penalized at the rate of 10% for each day or part of each day past the due date. Reports or assignments submitted more than seven days after the due date will not be marked.

What is the course policy regarding group vs. individual work?

Group work is an integral part of this course. We wish to actively encourage group learning and cooperation in both the lab. However, all lab assignments and reports must be written individually and independently.

Important: The most common form of plagiarism encountered to date involves students copying from one another. See category 4 under Plagiarism (below). Therefore, your best interest will be served by ensuring that your papers/ assignments are based on your own efforts (i.e. original to you) and are not placed in a position of vulnerability prior to submission for grading.

What is plagiarism?

According to Section VIII (Academic Offences), from the UNB Undergraduate Calendar, plagiarism includes the following:

1. quoting verbatim or almost verbatim from a source (such as copyrighted material, notes, letters, business entries, computer materials, etc.) without acknowledgment;
2. adopting someone else's line of thought, argument, arrangement, or supporting evidence (such as, for example, statistics, bibliographies, etc.) without indicating such dependence;
3. submitting someone else's work, in whatever form (film, workbook, artwork, computer materials, etc.) without acknowledgment;
4. knowingly representing as one's own work any idea of another. If you have any questions/concerns/doubts regarding sources of information and how these should be credited - ask for clarification before submitting your work.

The penalties for plagiarism outlined in the University Calendar can be severe. Most cases of plagiarism are unintentional and come about from ignorance or misunderstanding. You can save yourself a lot of time and grief by knowing what constitutes plagiarism and then avoiding it.

If I'm having problems, what should I do? Who should I speak to?

Students are encouraged to seek assistance at any time if they are having problems or difficulties, no matter how inconsequential they may seem. Speak to the instructor or to a lab demonstrator. If the teaching staff perceives problems, they will certainly offer their assistance whenever and wherever they can. However, sometimes we are not as observant as we would like to be and so, in these instances, we rely on you taking the initiative to seek us out.

What is the grading scheme in this course?

The grading scheme is outlined above in section 6 of this document.

12. Student information sheet

Please complete the following and give to the Instructor or Demonstrator before you leave today's lab

1. Receipt of Course Syllabus

I have **read** and **understand** the document outlining the course regulations and requirements for Biology 2018.

Name: _____

Signature: _____

Student #: _____ Date: _____

****

Medical/Emergency Contact Information

All information provided on this sheet is confidential and will be kept in a secure place. In preparation for the fieldwork conducted in our course, it is helpful to know the following:

2. Medical/Emergency Information

a). Are you under any medical treatment we should be aware of?

_____

b). Do you have physical limitations that could affect your ability to do lab work?

_____

c). Do you have any allergies we should be aware of? Do you carry an **EpiPen**?

_____

3. Contact Outside of School Hours & Emergency Contact Person

Occasionally the need arises for us to contact a student outside of regularly scheduled hours. In these cases, it is helpful if we know the student's home phone number and/or email address(es):

Home Phone: _____

Emergency Contact Person: _____

Relationship to you: _____

Emergency Contact Phone #s:

(day)_____(evening)_____