Syllabus for
BIOL 4103 – Population Genetics – Fall 2015
Root Gorelick

Monday & Wednesday 10:05 – 11:25 am 3201 River Building

Contact Information

Phone – 613-520-2600 ext 1586 (warning: I am horrible about checking voice mail)
E-mail – Use cuLearn e-mail (your e-mails may get lost in my other e-mail account)
Office Hours: Thursday 1:00 – 2:30 pm (or by appointment)
Office – 4625 CTTC (just south of the gym and child care)

Prerequisites

BIOL 2104 (Introductory Genetics) is a prerequisite.
Mathematical sophistication is also required; facility with calculus would be helpful.

Semester Schedule

Week of	Chapter of Text	Topic
2 September	1	What is population genetics
9 September	2	Hardy-Weinberg equilibrium
14 September	1	Measuring variation; Segregation
21 September	2	Linkage disequilibrium and Recombination
28 September	-	Epistasis
5 October	3	Drift and Coalescent
14 October	-	Thanksgiving and catching up
19 October	4	Mutation
28 October	-	Fall Break
2 November	5	Selection and Fisher's fundamental theorem
9 November	6	Population structure 1: inbreeding & outbreeding
16 November	6	Population structure 2: Wright's shifting balance
23 November	8	Putting it all together
30 November	-	What is population genetics? (reprise)

Course objectives

1. Appreciation for population-level thinking in science – variation versus averages
2. Appreciation for mathematics in biology
3. Deep understanding of evolutionary theory
4. Critical thinking and the "3 R's" (reading, writing, arithmetic)

Readings – Primary Literature

In addition to reading from the textbook, you will be required to read and be ready to discuss the following papers each week. This is an integral part of the course. You will also be tested on these papers each week, so it behooves you to be prepared. I have intentionally chosen papers that can be accessed electronically from the Carleton Library website (web access to Ross (2006) is a little tedious, but still findable). It is your responsibility to find and either download or print these papers. You will also need to purchase a very small course-pack from the Carleton Bookstore with only the very first reading. [N.B. all dates below are Mondays, except when there is no class on Monday]

9 September	McShea DW and Brandon RN. 2010. *Biology's First Law: the tendency for diversity and complexity to increase in evolutionary systems*. Chapter 3: Diversity. Pages 25-43. University of Chicago Press. ISBN 978-0-226-56224-4.
14 September	Kirkpatrick M, and Jenkins CD. 1989. Genetic segregation and the maintenance of sexual reproduction. *Nature* 339: 300-301.
21 September	Gorelick R and Laubichler MD. 2004. Decomposing multilocus linkage disequilibrium. *Genetics* 166: 1581-1583.
28 September	Hansen TF. 2013. Why epistasis is important for selection and adaptation. *Evolution* 67: 3501-3511.
5 October	Millstein RL. 2002. Are random drift and natural selection conceptually distinct? *Biology & Philosophy* 17: 33-53.
14 October	No reading; Thanksgiving is 12 October
19 October	Ross KA. 2006. Alpha radiation is a major germ-line mutagen over evolutionary timescales. *Evolutionary Ecology Research* 8: 1013-1028.
2 November	Edwards AWF. 2002. The fundamental theorem of natural selection. *Theoretical Population Biology* 61: 335-337.
9 November	Lynch, M. 1991. The genetic interpretation of inbreeding depression and outbreeding depression. *Evolution* 45: 622-629.
16 November	Skipper RA. 2002. The persistence of the R.A. Fisher-Sewall Wright controversy. *Biology & Philosophy* 17: 341-367.
23 November	Gorelick R, Olson K. 2013. Polyploidy is genetic hence may cause non-adaptive radiations, whereas pseudopolyploidy is genomic hence may cause adaptive non-radiations. *Journal of Experimental Zoology* (*Part B. Molecular and Developmental Evolution*) 320B: 286-294.

Weekly quizzes

There will be eleven (11) weekly quizzes worth 10% each plus a final quiz worth 20%. The final quiz will be on the last day of class, Wednesday 2 December, and will count for 20% of your final mark. I will drop your three lowest quiz marks, unless the lowest mark is on the final quiz, in which case I will drop the mark for the final quiz plus your other lowest quiz mark. Except for the final quiz, all quizzes will be on Wednesdays at the start of class.

There will be no make-up quizzes. If you miss a quiz, you will receive a zero, which will then count as one of your three lowest quiz marks (or count as two of your lowest quiz marks if you miss the final quiz on 2 December).

If you arrive late for a quiz, you will not receive extra time to complete it. For example, if you arrive 10 minutes late for a 15 minute quiz, you will only be allowed 5 minutes for the quiz. Only some of the time will you be allowed to bring a calculator, but should probably never need one. For some quizzes (e.g. the very first quiz), I will specifically prohibit calculators so that you become adept with manipulating fractions and algebraic expressions.

Some weeks I may opt to give you a written assignment in lieu of a quiz. In such instances, those will be assigned on Monday and due two days later at the start of class on Wednesday. For example, the quiz on 23 September will be replaced with an assignment due that day; hand it in electronically before the start of class if you cannot be present in class because of Eid or Yom Kippur. Because I will review the answers at the start of class on Wednesday, late papers will get a grade of zero.

I reserve the right to make the material on quizzes cumulative, but will usually only explicitly cover the entire term's worth of content on the final quiz on 2 December.

Schedule of Quizzes (all on Wednesday; all worth 10% each, except the final one worth 20%)

9 September	7 October	4 November
16 September	14 October (after thanksgiving)	11 November
23 September	21 October	18 November
30 September	(fall break)	25 November
		2 December (20%)

Academic Integrity Policy

The University is committed to ensuring fairness and consistency in the completion of examinations, including quizzes. As part of this commitment, students are required to follow proper examinations procedures. A student who commits a violation of this policy on an examination, test, or take-home examination, or obtains or produces an answer or unfair advantage by deceit, fraud, or trickery, or by an act contrary to the rules of the examination are subject to the sanction under this Policy. These rules include but are not limited to:

- attempting to read any textbook, notebook, memorandum, other written material or mechanical or electronic device not authorized by the examiner;
- writing an examination or part of it, or consulting any person or materials outside the confines of the examination room without permission to do so;
- leaving answer papers exposed to view;
- attempts to read other students' examination papers and/or speaking to another student (even if the subject matter is irrelevant to the test).

CULearn – Electronic Communication:

BIOL 4013 will be managed with CULearn system: https://carleton.ca/culearn/
You must have a computing account to access the course CULearn webpage.
At a minimum, we will be using the following features of CULearn:

Notices – I will post updates and information about the course on the CULearn course home page, so be sure to check it regularly.

Course e-mail – CULearn has an e-mail account specific to each course that is accessible only to students registered in the course. I will send individual messages and course notices using the CULearn e-mail, so check your account frequently. Use this method for course-related e-mails and not my other e-mail accounts.

> **NOTE**: Your e-mails must be formal, polite, and proofread in order to guarantee a response from me. I reserve the right to ignore e-mails that are filled with spelling and grammatical errors. Use the automatic spelling and grammar checker, possibly cutting-and-pasting from a word processor. I reserve the right to ignore e-mails that address me only by my first name or otherwise appear overly colloquial. You are here to learn, which includes learning how to effectively communicate with those who evaluate your work.

Grades – I will post grades on CULearn. For your grades to be posted and for you to access the course CULearn webpage, you must be registered for this course and have a computing account. You will then have access to your grades and not to anyone else's. Note, an incorrect or missing student ID number on scantrons will result in your exam grades not being posted on-line.

Appeals of grades must occur via a CULearn e-mail to me within one week (7 calendar days) of the date that the grades were first posted on CULearn and the paper(s) was/were returned to you. At a minimum, include a copy of the original paper as an attachment plus a detailed argument in support of your appeal.

Grades for the final quiz and the total course mark will NOT be posted on CULearn because I do not officially give you a grade for the course. I only recommend a grade to the department chair, who in turn recommends a grade to the dean. So as not to usurp the dean's authority, I will not release the final quiz marks on CULearn nor otherwise provide them to you, at least not immediately. However, once the registrar releases final course grades, you are free to ask me about final quiz grades.

Requests for Academic Accommodations

You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. Please review the course outline promptly and write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. See the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://carleton.ca/equity/accommodation.

For Students with Disabilities:
Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam(s) in this course, please submit your request for accommodations to PMC by the deadlines published on the PMC website.

For Religious Obligations:
Students requesting academic accommodation on the basis of religious obligation should make a formal, written request to me for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event. Accommodation is to be worked out directly and on an individual basis. I will make accommodations in a way that avoids academic disadvantage to the student. For more details, see Carleton Equity Services "Student Guide".

Students who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies, or may contact an Equity Services Advisor in the Equity Services Department for assistance.

For Pregnancy:
Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a *letter of accommodation*. During the first two weeks of class or as soon as possible after the need for accommodation is known to exist, the student must write to me with any requests for academic accommodation.

Text

The required text is Hartl and Clark's *Principles of Population Genetics* (Sinauer). Both the Carleton Bookstore and Haven Books are carrying the 4th edition. Hartl & Clark is the definitive non-mathematical population genetics text. If you read and understand it, you will have a firm grasp of the fundamentals of population genetics, although not necessarily a grasp of the mathematical tools used by many aficionados in the field. It will be on sale at the Carleton Bookstore and Haven Books.

For those of you willing to delve into something more mathematical, read John Gillespie's *Population Genetics*: *A Concise Guide*. (Johns Hopkins University Press). I believe that Gillespie's book is the best population genetics text on the market and is affordably priced! However, had I assigned it as the text, its mathematics would have caused many of you to revolt.

Science Student Success Center

The "Science Student Success Centre" in Herzberg Building offers help to all science students, from helping to secure summer jobs, to improving chances at getting accepted to medical school, to helping learn how to improve grades in Carleton science classes. Events include orientation workshops, mini-conferences, science-related events, and one-on-one mentoring.
Voice: 613- 520-2600 ext 3111 Email: sssc@carleton.ca URL: www.carleton.ca/sssc

Note Taking and Sharing

See the following link (here) for great ideas on taking and sharing your own class notes, that recommends **Evernote** and **Google Drive**, which I neither endorse nor disparage (i.e. "no comment").

You are welcome to bring a laptop to lecture for note taking, but turn off ("mute") all audio and do NOT distract your colleagues with games, movies, YouTube videos, or any NSFW content.

Classroom decorum

I strongly encourage you to speak up and participate both in class and out of class, albeit in a respectful manner. In class, pretend that you are a courtroom lawyer. Your job is to advocate, albeit in this context advocating on your own behalf. Please don't forget that you are co-equals with each of your colleagues in the class.

Four keys to success in class

Read and understand Mike Dorf's brilliant 23 August 2010 *FindLaw* column (here).
Although written about law school, Mike Dorf's article is applicable to any university course.

Caveats

I reserve the right to alter this syllabus at any time, but promise to only do so for good cause, such as severe swine flu pandemic. If I get hit by a bus or something akin to that, whoever takes over teaching the course also reserves the right to alter the syllabus. The only time I previously altered a syllabus during middle of the term was due to a labour strike and consequent loss of a few weeks of labs.

In the highly unlikely event you are curious about my research, only some of which is on population genetics, and my other activities at the university, please see my website (rootgorelick.com).