BIOC16H3 – EVOLUTIONARY GENETICS & GENOMICS

WINTER 2017

COURSE SYLLABUS

Lecture: Tuesday, 14:00-16:00, BV 361
Tutorial: Thursday, 13:00-15:00, PO 101

Instructor: **Dr. Mark Fitzpatrick**
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Teaching Assistant: **Allan Edelsparre**
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DESCRIPTION: This course will cover the fundamentals of modern ecological and evolutionary genetics and genomics. The course begins with an overview of genetic variation, its measurement, and the forces responsible for the origin and maintenance of variation. The remainder of the course describes the ecological and evolutionary context of natural selection, and the forces that shape genetic variation and genomic within and between species. Emphasis will be placed on experimental studies of natural populations, and the relationship between theory and experiments. Overall, the goal of this class is to enable students to apply insights gained from classic and modern genetic and genomic techniques to understand how variation is produced, maintained, and distributed within and among populations.

LEARNING OBJECTIVES:

1. Understand the importance of the four agents of evolution and how they change allele frequencies in populations.
2. Calculate and apply Wright's F-statistics that are used to understand population differentiation.
3. Develop a basic understanding of quantitative genetics, QTL mapping, reaction norms, and the evolutionary significance of phenotypic plasticity.
4. Understand and apply the usage of positive Darwinian selection to assess i) genetic evolution in a population, ii) evolutionary divergence between related species.
5. Gain a basic understanding of how genes arise and evolve.
6. Develop a basic understanding of proteomics and functional genomics for understanding the evolution of genomes.
7. Develop solid oral presentation skills and the confidence to talk in front of your peers.
8. Gain the skills necessary to critically analyze and discuss cutting edge scientific papers.

REQUIRED TEXTBOOK:

Conner JK & DL Hartl (2004) A Primer of Ecological Genetics. Sinauer Associates.
http://bit.ly/2hStYUS
http://amzn.to/2gUL7LW

This text will be available at the bookstore. It will be used extensively during the course. Additional readings will be provided as necessary

OTHER RECOMMENDED TEXTS:

Gibson G & SV Muse (2009) A Primer of Genome Science. 3rd ed. Sinauer Associates.
http://amzn.to/2h3gtmT
e-book link: http://www.coursesmart.com/9780878932368

Pagel M & A Pomiankowski (eds). 2008. Evolutionary Genomics & Proteomics. Sinauer Associates.
http://amzn.to/2hSqCRR

OTHER READINGS: Any additional lecture readings along with pdfs for the tutorial paper discussions will be available on Blackboard.

TUTORIALS: Weekly tutorials will be run as discussions of key scientific papers and associated methodologies. The beginning weeks will feature example presentations and presentation tips by the TA. The following weeks will consist of presentations and discussions led by students in the class. Each student is required to present one (1) paper during the term and lead the corresponding class discussion pertaining to that paper. The grading rubric will be discussed during the initial tutorials. A candidate list of papers will be provided by the instructor/TA.

Students are also required to submit nine (9) assignments during the term that consist of summaries and discussion questions. This will include one summary per week (students will not submit a summary on the week of their presentation). Students must select one paper from the papers to be discussed each week and submit a single page précis that summarizes the hypotheses, experimental approaches, major findings, and broad significance of the paper. In addition, students must also submit four discussion questions stemming from that paper.

GRADING & EVALUATION:

Final Exam (3hrs)	35 %
Midterm Exam (2hrs, in class)	25 %
Presentation & Discussion	15 %
Problem Set	7 %
Summaries with Questions (9 @1.44% each)	13 %
Participation	5 %
TOTAL	*100%*

Note: The final examination will be cumulative, however, a greater emphasis will be placed on the material covered after the midterm.

ACADEMIC POLICIES: The University of Toronto has strict policies on academic integrity and plagiarism. Academic dishonesty tarnishes U of T's reputation and discredits the accomplishments of students. The university is committed to providing students every possible opportunity to grow in mind and spirit; however, this pledge can only be redeemed in an environment of trust, honesty, and fairness. As a result, all members of the academic community at large regard academic dishonesty as a serious offense. This policy sanctions students engaging in academic dishonesty with penalties up to and including expulsion from the university for repeat offenders.

For more information please follow this link below for the University of Toronto's Code of Behaviour on Academic Matters. http://www.governingcouncil.utoronto.ca/policies/behaveac.htm

ACCESS FOR STUDENTS WITH DISABILITIES: Individuals who have any disability, either permanent or temporary, which might affect their ability to perform in this class are encouraged to inform the instructor at the start of the term and also contact Access*Ability*. Materials or testing may be modified to provide for equitable participation. I will work with you and Access*Ability* Services to ensure that you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

MISSED EXAMS: There will be no make-ups for the midterm exam. Students unable to attend the midterm for religious reasons must notify the instructor as soon as possible. Students who are unable to attend the midterm due to illness must notify Prof. Fitzpatrick (by telephone or email) within 3 working days of the test. Acceptable reasons for missing a test include: illness (a doctor's note will be required, see below), death of a close family member, and *severe* storm days. Unacceptable excuses include: having another midterm on the same day, extended reading week travel plans, and minor traffic and weather disruptions.

Students who miss the midterm for a medical reason must present a completed UTSC medical certificate (available via the registrar's website) that confirms their illness, and medical attention, at the time of the exam. *Medical certificates will be verified*. Students who miss the midterm and have provided acceptable documentation must make arrangements with Prof. Fitzpatrick for alternative evaluation or increasing the weight of their final exam. Students that miss the midterm with no acceptable, documented excuse will receive a grade of zero. Students that miss the final exam must petition the Registrar to write a deferred exam.

DISCLAIMER: The instructor reserves the right to modify this syllabus and lecture schedule as necessary throughout the term to better achieve course objectives and/or enhance the quality of instruction. As such, the lecture and tutorial outlines provided below are tentative. Notification of changes will be made in class and the most up-to-date version will always be the one available on Blackboard. You are responsible for being aware of the contents of this syllabus.

TENTATIVE* **LECTURE SCHEDULE:**

Date	Topic	Reading
03 Jan	Introduction / Syllabus	C&H Ch 1
10 Jan	Measuring Genetic Variation	C&H Ch 2
17 Jan	Changes in Allele Frequency I	C&H Ch 2/3
24 Jan	Changes in Allele Frequency II	C&H Ch 3
31 Jan	F-Statistics & Population Differentiation	C&H Ch 3
07 Feb	Quantitative Genetics I: Introduction & Heritability	C&H Ch 4
14 Feb	Quantitative Genetics II: Phenotypic Plasticity, Reaction Norms, Linkage Disequilibrium	C&H Ch 4
21 Feb	*No lecture (Reading Week)*	
28 Feb	**Midterm Exam (in class)**	
07 Mar	Quantitative Genetics III: QTL Mapping	C&H Ch 4
14 Mar	Detecting Positive Selection	Biswas & Akey 2006 TREE
21 Mar*	Genomics: The Evolution of New Genes & Lateral Transfer	tba
28 Mar*	Genomics: Proteomics & Functional Genomics	tba

* = these lecture topics may be modified by the instructor