

## OEB125: Molecular Ecology and Evolution, Fall 2020

**Instructor:** Scott V. Edwards, Professor, OEB/MCZ  
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**Office hours:** Mon, 10-11am; 1-2pm

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**Office hours:** Fri, 12 noon-1pm or by appointment

Lectures will be held on Tuesdays and Thursdays from 12:00 – 1:15 pm.

**Laboratories to be scheduled; tentatively Wednesdays or Fridays 10-12 or 3-5 PM.**

Zoom link for all classes:

<https://harvard.zoom.us/j/93843706856?pwd=aHVUeUNSZWNOdGV6M3JjZDNvc05WZz09>

### Lecture Schedule

Week	Date	Section title/topic	Reading*
		<b>Principles of Molecular Evolution</b>	
1	Sept. 3	Course Introduction	MGE, chapter 1
2	Sept. 8	Gene structure, genetic code	MGE, chapter 8
	Sept. 10	Genes and genomes	MGE, chapter 9
3	Sept. 15	Population Genetics I: mutation, genetic drift	MGE, chapter 2
	Sept. 17	Population Genetics II: drift continued, fixation	MGE, chapter 2, IME chapter 7
4	Sept. 22	Genetic drift continued	MGE, chapter 4
	Sept. 24	Phylogenetic methods: parsimony and distance methods	MGE, ch. 5: 165-177; 184-194
5	Sept. 29	Phylogenetic methods: likelihood and Bayesian methods	MGE, ch. 5: 194-198
	Oct. 1	Molecular clocks, neutral theory	MGE, chapter 2, IME, chapter 8
6	Oct. 6	Nearly neutral theory; linkage and selection	MGE, chapter 12
	Oct. 8	Gene regulation, duplication and adaptation	MGE, chapter 7
	Oct. 8	<b>DEBATE:</b> The Neutral Theory of Molecular Evolution	MGE, chapters 3,5
7	Oct. 13	<b>Midterm Exam</b>	
		<b>The Tree of Life</b>	
	Oct. 15	Genes trees and coalescent theory	IME, chapter 9
8	Oct. 20	Gene trees and species trees	Paper handout
	Oct. 22	Phylogenomics and the Tree of Life	MGE, chapter 10, IME, chapter 11

	Oct. 22	<b>DEBATE:</b> Coalescence vs. concatenation in phylogenomics	
		<b>Genomic diversity within species and speciation</b>	
9	Oct. 27	Principles of phylogeography	IME, chapters 3, 9
	Oct. 29	Phylogeography in the next-gen era	IME, chapter 6
		<b>Specialty topics</b>	
10	Nov. 3	Plant phylogenetics and horizontal transfer	Paper handout
11	Nov. 5	Microbial genome evolution	Paper handout
	Nov. 10	Human evolution I	Handout
	Nov. 12	Human evolution II	Handout
	Nov. 12	<b>DEBATE:</b> Genomics and human population variation	
12	Nov. 17	Genome variation in health and disease	IME, chapter 12
	Nov. 19	Conservation genetics	IME, chapter 10
13	Nov. 24	Conservation genetics	IME, chapter 10
14	Dec. 1	Wrap up - review	
14	Dec. 3	<b>In-class Final exam</b>	
	Dec. 9	<b>Final projects due</b>	

\*Course textbooks, available for purchase online, at the Coop and elsewhere (we will also have pdfs of each chapter available for temporary “loan” as if from a library):

Abbreviations: MGE = *Molecular and Genome Evolution*; IME= *An Introduction to Molecular Ecology*.

1) *Molecular and Genome Evolution*

(Dan Graur, 2016); Sinaur Associates/Oxford University Press (ISBN 9781605354699).

2) *An Introduction to Molecular Ecology* 3<sup>rd</sup> edition. 2017. Graham Rowe, Michael Sweet and Trevor Beebee. ISBN: 9780198716990. Publisher: Oxford U. Press.

**Review sessions** can be arranged with the instructors, and will be held before the midterm and final exams at times to be arranged.

## OEB125 Computer labs - Wednesdays 10-12 or 3-5 PM

Week	Topic	Software	Homework due this week
1	No meeting	-	No assignment
2	Discussion	-	2 page paper contrasting Kimura's view of organismal and molecular evolution
3	Genbank and sequence	NCBI/Genbank/Aliview	Peer-critiques of 2 page

4	alignment Parsimony and bootstrapping	Paup*/PHYLIP	paper; revision of paper Lab homework; Genbank
5	Molecular clock and distance methods; Maximum likelihood	PHYLIP, Lintre, Phym1	Lab homework: parsimony
6	Measuring selection	PAML	Lab homework: molecular clock
7	Species trees and coalescence	Phybase (R); MP-EST	
8	<del>Bayesian phylogenetics</del>	<del>BEAST and *BEAST</del>	Present initial project outlines
9	Gene flow and genetic diversity within species	DNAsp and MIGRATE	Refine project paragraphs; identify specific data sets for analysis
10	Genetic diversity II/Species delimitation	Bayesian phylogenetics and phylogeography	Lab homework: gene flow
11	Consult on final projects	Individual meetings	Lab homework: BPP
12	Work on projects	Open lab	-
13	Work on projects	No lab	-
14			Final projects due Dec 9

### Collaboration Policy Statement

Discussion and the exchange of ideas are essential to doing academic work. For assignments in this course, you are encouraged to consult with your classmates as you work on problem sets. However, after discussions with peers, make sure that you can work through the problem yourself and ensure that any answers you submit for evaluation are the result of your own efforts. In addition, you must cite any books, articles, websites, or lectures that have helped you with your work using appropriate citation practices. Similarly, you must list and acknowledge the names of students with whom you have consulted on problem sets. This policy applies both to weekly problem sets as well as to final projects.

### Grading:

Activity	Percent of final grade
Laboratories, Homework and Discussion	25
Midterm Exam	25
Final Project	25
Final Exam	25