

## **BIOC50: Macroevolution**

<b>Person</b>	<b>Role</b>	<b>Contact</b>	<b>Office Hours</b>
Professor Weir	Instructor	jason.weir@utoronto.ca	Monday 1:00 to 2:00pm SW549
Alfredo Barrera	TA	abarreguzm@gmail.com	Tuesday 1:00 – 2:00am BV498

### **CONTACTING US**

Please use contact e-mails and use of subject line of “BIOC50”

### **COURSE EVENTS**

Lectures: MW 120 Monday 11:00am – 1:00pm

Tutorials: BV 498 Tuesday 12:00 – 2:00pm (you may stay until 2:00pm, but should aim to have tutorial assignments done by 1:30pm).

### **COURSE OVERVIEW**

This course consists of two parts: 1) a lecture-based section covering the evolutionary history of life on Earth and the evolutionary processes that result in macroevolution and 2) a computer based tutorial providing basic understanding of how to generate phylogenetic trees from DNA and proteins and how to use those trees to address macroevolutionary questions.

### **COURSE PREREQUISITS**

BIOB50 and BIOB51. All students are expected to have an understanding of basic evolutionary processes: adaptation, natural selection, sexual selection, genetic drift. Many of these processes assume knowledge of ecological niches and how ecology may influence adaptation and natural selection.

### **TEXTS AND READINGS**

Class Text: D.J. Futuyma. Evolution 3<sup>rd</sup> Ed. 2013. Sinauer Associates. (All required readings are from this text. For the history of life section of this course we will augment this text with suggested readings from the following two texts, both of which are on reserve at the library.)

Suggested Text: R. Cowan. History of Life 4<sup>th</sup> ed. 2005. Blackwell Publishing (Lectures from Jan 17 to Feb 28 will use this text as a major source dealing with the history of life. Some information, in particular the phylogenetic trees, is out of date, so be sure to follow lectures closely.)

Additional Text: S. Freeman & JC Herron. Evolutionary Analysis, 4th Edition. 2007. Pearson/Benjamin Cummings. (Chapter 17 is the main source for the lectures on Jan 17 dealing with origin of life and Precambrian evolution)

## STUDY TOOLS

Course Homepage: The homepage for this site is on blackboard. On the homepage you will find all the information for the course including a copy of this syllabus, an outline of the course content, lecture slides, tutorial handouts, tutorial datasets and announcements.

Lecture sides: Key lecture slides will be posted on the course homepage as PDF files the evening before lecture. These may be printed, brought to class and used to augment your note taking. You WILL still need to take notes, but printouts of lecture slides will mean that you do not have to write down everything during lecture.

Attendance at lectures: There is no web option for this course. Looking over the lecture slides in combination with the reading materials listed at the end of each lecture handout should provide you with the information you need to know if a lecture is missed, but this will require more work than simply attending lectures.

Tutorials: These computer-based tutorials provide practical skills for addressing macroevolution. They generally cover topics in the previous lecture. Attendance at tutorials is mandatory. Tutorial assignments are due at the end of each tutorial. If you miss a tutorial you cannot make up the missed assignment except with a valid doctor's note. However, you can still go through the tutorial outside of class-time as all computer programs used during tutorial are freely available on the web. Tutorial materials will be posted by noon on the Monday before each tutorial. You can access these electronically during tutorials. They may be printed but this is not required for tutorials.

## EVALUATION

Test	Covers	Proportion of Final grade
Midterm	First 6 lecture days	35%
Final	Last 6 lecture days	35%
Tutorial Assignments	1 assignment each week	15%
Tutorial open book exams	2 exams, each covering preceding 5 tutorial topics	15%

**Exams:** This course covers the evolution and diversification of life. As such there are a lot of taxonomic names you will be presented with in lecture. Names of taxonomic groups covered in lectures will be provided on a sheet in alphabetical order during both the midterm and the final exams. You should be familiar with the taxonomic groups covered but you do not need to memorize spelling. Also, the course will present a lot of phylogenetic trees. You will not be asked to draw a phylogenetic tree from memory, but you may be asked to label the species at the tips of a phylogenetic tree and know where along the tree key evolutionary innovations occurred.

**Tutorial open book exams:** During tutorial exams you will apply the information learned in previous tutorial assignments to novel macroevolutionary questions. You will be given minimal instructions during the exam on the steps you need to take, but the exam will be open book meaning you can bring your textbook, another book, your own notes and previous tutorial assignments. You will not be permitted to communicate electronically or otherwise during tutorial exams. Doing so will be considered academic dishonesty and will be treated accordingly.

**Make-up exams:** Students unable to attend a midterm or tutorial exam for religious reasons must notify the instructor by e-mail as soon as possible after announcement of the date of the exam, in order to make alternate arrangements. Students unable to make a midterm or tutorial exam due to sickness must contact the instructor by e-mail within 3 working days of the test, must present the instructor with a valid doctor's note and must complete a UTSC medical certificate (available via the registrar's website) which confirms their illness, and medical attention at the time of the exam.

Students who miss a final exam must petition to the registrar.

## LECTURE TOPICS AND READINGS

Lecture	Date	Topic*	Lecture title	Futuyma textbook reading	"History of Life" Suggested reading
1	1-Sep-16	MT	Course Introduction		
1	1-Sep-16	MT	Classification and phylogeny	Futuyma Chapter 2	
2	12-Sep-16	HL	Evolution towards life	Futuyma pg. 78-81, 104-106	Cowan chapter 1
3	12-Sep-16	HL	Precambrian life	Futuyma pg. 107-110	Freeman pg. 660-680
4	19-Sep-16	HL	Ediacaran, Cambrian and Ordovician	Futuyma pg. 111-115	Cowan Chapter 5; Freeman pg. 694-702
5	19-Sep-16	HL	Evolution and diversification of plants	Futuyma pg. 115-121	Cowan Chapter 8 (plant section)
6	26-Sep-16	HL	Evolution of vertebrates	Futuyma pg. 83-85, 122-125	Cowan Chapter 7 (phylogenetic trees out of date)
7	26-Sep-16	HL	Leaving the water – evolution of land tetrapods	Futuyma pg. 83-85, 122-125	Cowan Chapters 8 (land animal section), 11
8	4-Oct-16	HL	Marine monsters of the Mesozoic	Futuyma pg. 83-85, 122-125	Cowan Chapter 14 (Marine part)
9	4-Oct-16	HL	Evolution of pterosaurs and Dinosauria	Futuyma pg. 83-85, 122-125	Cowan Chapter 2 12, 13 (pterodactyl section)
	17-Oct-16	HL	<b>Midterm</b>		
10	24-Oct-16	HL	Evolution of birds	Futuyma pg. 85-86	Cowan Chapter 15
11	24-Oct-16	HL	The K/T mass extinction and other mass extinctions	Futuyma pg. 125-133	Cowan Chapter 16, 17, 18
12	31-Oct-16	HL	Origin and diversification of mammals	Futuyma pg. 86-90, 126-128,	Cowan Chapter 15, Cowan Chapter 19, 20
13	31-Oct-16	MP	Evolution of primates	Futuyma pg. 90-	Cowan Chapter 19, 20

			and humans	95; 149-164	
14	7-Nov-16	MP	The evolution of biodiversity	Futuyma Chapter 7	
15	7-Nov-16	MP	Speciation part 1	Futuyma Chapter 17	
16	14-Nov-16	MP	Speciation part 2	Futuyma Chapter 17/18	
17	14-Nov-16	MP	Speciation part 3	Futuyma Chapter 18	
18	21-Nov-16	MP	Coevolution	Futuyma Chapter 19	
19	21-Nov-16	MP	Macroevolution	Futuyma Chapter 22	
	28-Nov-16		TBA		

\* **Lecture Topics:** MT = Macroevolutionary tools, HL = The History of Life, MP = macroevolutionary processes

## TUTORIAL DATES AND TOPICS

Tutorial	Date	New Phylogenetic Skill	Biological Topic
1	6-Sep-16	Genbank, genetic distances	Calibrating rates of molecular evolution
2	13-Sep-16	Parsimony	Horizontal gene transfer in bacteria and Archaea
3	20-Sep-16	Bootstrapping	Plant evolutionary history
4	27-Sep-16	Parsimony on morphometric data	Are turtles Anapsids or Diapsids?
5	18-Oct-16	Maximum likelihood	Are birds dinosaurs or earlier tetrapods?
6	25-Oct-16	TUTORIAL MIDTERM	Classified – top secret
7	1-Nov-16	Time calibrated trees and Parsimony based ancestor state reconstructions	When did the Great American Biotic Interchange in birds occur?
8	8-Nov-16	LTT plots, speciation and extinction rate estimates	Diversification rates in Neotropical birds
9	15-Nov-16	Maximum likelihood based ancestor state reconstruction	Evolution of swords in swordtail fish
10	22-Nov-16	Effect of character state on speciation and extinction rate estimates	Comparing rates of speciation and extinction in the Andes versus lowland along a phylogeny of tanagers
11	29-Nov-16	TUTORIAL FINAL	Classified – top secret