PCB 4674 Evolution – Spring 2020 Syllabus

Instructor: Dr. Charles Baer

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Office Hours: Thursday period 3-4 (~9:30-11:30)

Teaching Assistants:

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Office Hours:	Discussion section	Discussion section

Credits: 4

Time / Room:
Lecture: MW Period 3-4, 211 Bartram
Lab: Fri. Period 3-4, 5-6, 7-8, 521 Carr

Class web page: PCB4674 in Canvas

Prerequisites: BSC 2010 or the equivalent. Familiarity with Mendelian genetics, basic molecular biology, and high-school algebra.

Texts: **(1) OPTIONAL but highly recommended.**

- Charlesworth, B. and D. Charlesworth, 2003. *Evolution: A Very Short Introduction*. Oxford University Press (~$7). **NOTE:** the C&C book IS "very short" (~130 pages). I ****HIGHLY**** recommend that upon purchasing the C & C book at the beginning of the semester you sit down and read it from cover to cover. That way (most of) the lecture material will be familiar when you encounter it and you can re-read the relevant material in the text as necessary.

(2) OPTIONAL, if you want a "real" textbook.

- Zimmer, C. and D. J. Emlen. 2016. *Making Sense of Life, 2nd ed*. MacMillan Press. This is the textbook that several other UF Biology Evolution instructors use, so you should be able to get a used copy for a reasonable price. I do not assign a formal textbook, but some students feel more comfortable having a text to draw on as a resource. There are many excellent textbooks on basic evolutionary biology besides the Z&E book; they all contain pretty much the same conceptual material, although the emphases and choice of examples will differ. I have posted a (partial) list on the course web page.

(3) Required.

- Yanai, I. and M. Lercher. *The Society of Genes*. Harvard University Press, ~$20. We will read The Society in the discussion section. Groups of 2-3 students will present one chapter from the book for discussion.
- Darwin, C., 1859. *The Origin of Species*, First Edition. *The Origin* is available for free online and a pdf is available on the class web page.

Discussion Sections: The "lab" section of the class will consist of discussion sections. Each week the class will read and discuss a chapter from *The Society of Genes*. The first ~ 45 minutes of each section will be devoted to discussion of the readings; groups consisting of two or three students will lead the discussion, which will be moderated by the teaching assistants. The remainder of the section will be devoted to a TA-led discussion of the week's Homework assignment. **NOTE: Homework is optional and will NOT be graded!** However, it is **HIGHLY RECOMMENDED!** (!!) Grading of the discussion section will be based on class participation, both in leading the discussion and in participating in discussions led by others. Material from the *The Society (*and *The Origin of Species*) will appear on the midterm and/or final exams.

In-Class Presentations: The last class period will be devoted to group presentations. This semester, the group presentation will be a **poster presentation** on an evolutionary topic of your choice. Groups will consist of three (or occasionally two) students, randomly assigned by me. Topics will be vetted by me; I reserve the right to modify or veto topics, but I promise I will use the veto sparingly. The posters will be presented during the last class period.

Grading:

Midterm Exams (2): 1/4 each (in class, closed book/notes)
In-Class Presentation (poster): 1/8 (peer grade 1/2, CFB grade 1/4, TA grade 1/4)
Discussion: 1/16 (based on presentation + class participation)
Final Exam: 5/16 (Take-home exam, open book)

Grading Policy:

Exams will be curved according to a normal distribution with a mean of 83% and a standard deviation equal to the observed, truncated at 100% (i.e., if your curved score is greater than 100%, it will be rounded down to 100%). The following table shows the proportion of students over the past three years who received a curved score greater than or equal to the percent grade indicated in the right column:

Proportion of students	**whose grade is greater than or equal to:**
0.903	70%
0.618	80%
0.242	90%
0.115	95%

For example, the top row indicates that 90.3% of students received a curved grade of 70% or higher. Note that **your curved score may be higher or lower than your raw score**. For example, if the class mean is higher than the mean of the curved distribution (83%), then your curved score will likely be lower than your raw score. **Your final score for each assignment will be the maximum of your raw and curved scores for that assignment.** Each exam will be curved separately.

The poster project will be graded similarly, except the lower tail of the distribution will be truncated at 80% except in special circumstances (e.g., an egregious lack of effort).

If your final curved % is ≥90%, you are guaranteed an A (not A-), if your final curved % is ≥ 80% you are guaranteed a B (not B-), if your final curved % is ≥ 66.67%

you are guaranteed a C (not C-). I reserve the right to curve downward, i.e., be more generous. Since UF does not recognize grades below C as passing, the only grade below C that I give is an E, i.e., if you pass the class you will receive at least a C.

Answer keys to exam questions will be posted on the class web page shortly after the due date. You are entitled to a re-grade on any assignment. Requests for re-grades must be submitted in writing to me (CB) no more than **one week** after the assignment was returned, with a ≤ 1/2 page typed explanation of why you believe justice was not served. I reserve the right to re-grade the entire assignment, not just the disputed question. All re-grades are final.

Make-up policy* - (1) *Mid-term and Final exams*. Make-up exams will be offered only in the case of verifiable medical and/or family emergency, or pre-identified special circumstance (e.g., a job interview, a wedding, etc.). Make-up exams will be two-hour, closed book essay exams. (2) *Presentations*. If you miss a Discussion section presentation, I will assign a suitable substitute assignment on an *ad hoc* basis.

Academic Ethics - Some exams in this class are take-home, open-book exams. You may consult any written or otherwise recorded source material (e.g., class notes, books, a recorded lecture, the vast, completely reliable source that is the Internet, etc.). **You may NOT (!) discuss ANY aspect of the exam with any other person!** By turning in your exam paper you confirm that you have adhered to ALL the rules and conditions of the exam. Suspected cases of academic dishonesty will (1) receive a grade of 0.0, and (2) be dealt with through the appropriate Departmental, College, and University channels.

Accommodations for students with disabilities: Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

Introduction: Evolution is at once the central organizing principle of biology and (along with climate change) the most controversial aspect of science currently in the public discourse. In this course we will examine the "The Theory of Evolution" in detail and break it down into its underlying components. As much as possible, important concepts will be introduced with simple mathematical models. Theoretical principles will be illustrated with real-world examples, with particular attention devoted to issues relevant to medicine, agriculture, and sociology. Controversial issues will be met head-on, not avoided. Moreover, you will have the opportunity and motivation to read *The Origin of Species* from cover to cover, which will place you in rarefied intellectual company. Upon successful completion of the course you will be able to lucidly and convincingly explain to friends, family, and random strangers why you do, or do not, "believe in evolution".

Class Schedule: Discussion section does NOT meet in weeks **highlighted in green**

Week	Day/Date	Lecture	Topic	Reading	Discussion
1	M 1/6	1	Introduction, Learning Objectives, Review of genetics and probability	Smocovitis; Handouts	**No discussion**
	W 1/8	2	Mutation and Genetic Variation	GenomesII TOC@NCBI; "The New Genetics", NIGMS	
2	M 1/13	3	A VERY brief intro to the history of evolutionary biology; Intro to Theoretical Evolutionary Biology - one locus, infinite population (H-W, general viability selection)	Barton et al.	*The Society of Genes*, Prologue
	W 1/15	4	Intro to Theoretical Evolutionary Biology II. Maintenance of genetic variation	TBA	
3	M 1/20		**MLK Holiday, no class**		SoG, Ch. 1
	W 1/22	5	Mutation and migration as evolutionary forces	TBA	
4	M 1/27	6	Evolution in a finite population I. Random sampling and the Wright-Fisher model.		SoG, Ch. 2 / Discuss HW1
	W 1/29	7	Evolution in a finite population II. Loss of genetic variation; effective population size; mutation and genetic drift.		
5	M 2/3	8	The Neutral Theory of (molecular) Evolution	TBA	SoG, Ch. 3 / Discuss HW2
	W 2/5	9	Non-random mating and its consequences		
6	M 2/10	10	Selection in finite populations; Intro to two-locus theory; linkage (dis)equilibrium	TBA	SoG Ch. 4 / Discuss HW3
	W 2/12	11	Two-locus theory, con't.; Intro to Quantitative Genetics	TBA	
7	M 2/17	12	Quantitative genetics II. Genetic variation, con't.; Selection and the response to it	TBA, Otto?	SoG, Ch. 5 / Discuss HW4
	W 2/19	13	Quantitative genetics III. Epistasis, GxE, evolution of correlated traits		

8	M 2/24	14	Evolution of sex and recombination I. The two-fold cost; Fisher-Muller; Muller's Ratchet	TBA	Exam, no Discussion
	W 2/26		**EXAM 1 (through lecture 13)**		
	M 3/2, W 3/4		**Spring Break, no class**		
9	M 3/9	15	Evolution of sex and recombination II. Red Queen; Kondrashov's Hatchet. Evolution of Sex ratio		SoG, Ch. 6
	W 3/11	16	Sexual selection	TBA	
10	M 3/16	17	Levels of selection	TBA	
	W 3/18	18	Adaptation and the genetics thereof	Spandrels, Spaniels	SoG, Ch. 7 / Discuss HW5
11	M 3/23	19	Speciation and the genetics thereof	TBA	
	W 3/25		**EXAM 2 (through lecture 18)**		Exam, no discussion
12	M 3/30	20	Phylogenetic inference I. Introduction	Barton et al. Ch.27	SoG, Ch. 8 / Discuss HW6
	W 4/1	21	Phylogenetic inference II. Con't		
13	M 4/6	21	The phylogenetic comparative method	Felsenstein '85	SoG, Ch. 9
	M 4/8	22	The Origin of Life on Earth	Weiss et al. 2016; Martin & Thauer '16	
14	M 4/13	23	The origin of the Eukaryotic cell	Embley & Martin	SoG, Ch. 10
	W 4/15	24	Extinction and the Fossil Record	TBA	
15	M 4/20	25	TBA	TBA	
	W 4/22		**Class project presentations; Final exam posted (due 5 pm Wed 5/1)**		**Review**

Homework Schedule

Week	Assignment	Software
3	Assignment 1 - Deterministic evolution at one locus	Populus
4	Assignment 2 - One-locus evolution in a finite population	Populus
5	Assignment 3 - One and two-locus evolution in a finite population	Populus
6	Assignment 4 - Introduction to Quantitative Genetics	Populus
9	Assignment 5 - Introduction to Bioinformatics	TBA
10	Assignment 6 - Intro to Phylogenetic Analysis	-