PCB 4674 Evolution – Syllabus

Instructor: Dr. Charles Baer

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Teaching Assistant:

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       Office Hours: Discussion section or by appointment

Credits: 4

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

Class web page: PCB4674 in Canvas

Prerequisites: BSC 2010 or the equivalent. Familiarity with transmission ("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. 2020. *Making Sense of Life, 3rd ed*. MacMillan Press. This is the textbook that some other UF Biology Evolution instructors use, so you should be able to get a used copy for a reasonable price. Earlier editions are also fine. 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.
- Dawkins, R. *The Selfish Gene*. Oxford University Press, ~$20, or probably a few bucks used. Voted "the most inspiring science book of all time" in a recent poll by the Royal Society. We will read *The Selfish Gene* in the discussion section. Groups of two students will present one or more chapters 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.

- Vonnegut, K(urt). 1985. *Galápagos*. Dial Press, ~$15. This is a classic, evolution-themed novel from an iconic American author of the 20th century. You can probably find a used copy for a few bucks at a used bookstore.

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 Selfish Gene.* The first ~ 45 minutes of each section will be devoted to discussion of the readings; groups consisting of two students will lead the discussion, which will be moderated by the teaching assistant. 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 Selfish Gene (*and *The Origin of Species*) will appear on the exams.

Class Project: Using Vonnegut's *Galápagos* for inspiration (but not as a template), the assignment is to write a ~1000-word short story based on the theme "Evolution from 2000 AD to 12000 AD". Let your imagination run wild! Since Natural Language AI (e.g., ChatGPT) is upon us, let's try the following exercise. YOU (i.e., a human) write your paper given the above instructions. THEN, give ChatGPT (*a*) the assignment, (*b*) the title of your story, and NEW FOR 2026! (*c*) the first and last sentences of your story, and two other sentences from somewhere in the middle of the story. And let's see what happens!

Grading:

    Midterm Exams (3): 1/4 each (in-class, closed book)
    Class project: 3/16 (2/3, peer grade** 1/3 CB grade)
    Discussion: 1/16 (based on presentation + class participation)
            ** I will explain the peer-grading scheme in a separate document

Grading Policy:

    Exams will be curved so that the curved mean is 80%. The following table shows the proportion of students over the past three years who received a curved average EXAM score greater than or equal to the percent grade indicated in the right column:

Proportion of students	whose exam grade is greater than or equal to:
0.81	70%
0.59	80%
0.32	90%

    For example, the top row indicates that 81% of students received a curved grade of 70% or higher. **Your final score for each assignment will be the greater of your raw and curved scores for that assignment.** Each exam will be curved separately.
        The class project will be graded similarly, except the lower tail of the distribution will be truncated at 80% except in special circumstances (i.e., an egregious lack of effort or obvious reverse engineering from AI).
        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) *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, wedding, athletic event, 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 –By turning in an assignment, you confirm that you have adhered to ALL the rules and conditions of the assignment. Suspected cases of academic dishonesty will (1) summarily receive a grade of zero, and (2) be dealt with through the appropriate Departmental, College, and University channels.

Accommodations for students with disabilities: Students requesting classroom (or online) 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 (me, CFB) when requesting accommodation.

Recorded Lectures: Lectures will not be officially recorded, but you are welcome to record them for your own use. Recorded lectures may **NOT** be shared without my written permission. Sharing recorded material without permission is a violation of the UF Honor Code (see https://aa.ufl.edu/policies/in-class-recording/). But, if you have to miss class for an excused absence, you are welcome to get someone to record the lecture for you, just let me know beforehand.

Introduction: Evolution is at once the central organizing principle of biology and one of the most controversial aspects of science currently in the public discourse (along with climate change and the origins, epidemiology and mitigation of the SARS-cov-2 virus). 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 1/12	1	Introduction, Learning Objectives, Review of genetics and probability	Handouts	**No Discussion**
		0	Mutation and Genetic Variation (Note: this is not a "lecture" that I will give in class, but the material is important to the class and you should be familiar with it).	GenomesII TOC@NCBI; "The New Genetics", NIGMS	
	W1/14	2-3	A VERY brief intro to the history of evolutionary biology; Intro to Theoretical Evolutionary Biology - one locus, infinite population (HWE)	Smocovitis	
2	M 1/19		**MLK holiday, no class**		*The Selfish Gene –*
	W 1/21	3.2	Intro to Theoretical Evolutionary Biology II. General viability selection		Foreward(s) & Ch. 1
3	M 1/26	3.3	Intro to Theoretical Evolutionary Biology iii: Maintenance of Genetic Variation		TSG – Ch.2
	W 1/28	4	Mutation and migration as evolutionary forces		
4	M 2/2	5	Evolution in a finite population I. Random sampling and the Wright-Fisher model.		TSG-Ch.3
	W 2/4	5.2	Evolution in a finite population II. Loss of genetic variation; effective population size; mutation and genetic drift.		
5	M 2/9	5.3	Evolution in a finite population III. The Neutral Theory of (molecular) Evolution		TSG-Ch.4
	W 2/11	6	Non-random mating and its consequences	TBA	
6	M 2/16	7	Selection in finite populations; Intro to two-locus theory; linkage (dis)equilibrium	TBA	TSG-Ch.5
	W 2/18	8	Two-locus theory, con't.; Intro to Quantitative Genetics	TBA	
7	M 2/23	8.2	Quantitative genetics II. Genetic variation, con't.; Selection and the response to it		TSG-Ch.6
	W 2/25	8.3	Quantitative genetics III. Epistasis, GxE, evolution of correlated traits; sexual selection	TBA	

8	M 3/2	9	Evolution of sex and recombination. **FULL TWO HOURS**		TSG-Ch.7
	W3/4		**EXAM 1 (through lecture 9, two-locus theory)**		
9	M 3/9	10	Levels of selection		TSG-Ch.8
	W 3/11	11	Adaptation and the genetics thereof	Spandrels, Spaniels	
3/16-3/20 SPRING BREAK					
10	M 3/23	12	Speciation and the genetics thereof		TSG-Ch.9
	W 3/25	**13**	**EXAM 2 (Through Lecture 12, Speciation)**		
11	M 3/30		Phylogenetic inference I. Introduction		TSG-Ch.10
	W 4/1	13.2	Phylogenetic inference II. Con't	Barton et al. Ch.27	
12	M 4/6	14	The Origin of Life on Earth	Weiss et al. 2016; Martin & Thauer '16	TSG-Ch.11
	W 4/8	15	Evolution of the Genetic Code	Wolf & Koonin '07; Koonin & Novizhilov 2017	
13	M 4/13	16	Virus World!	Koonin&Dolja, TBA	TSG-Ch.12,13
	W 4/15	17	The Origin of Eukaryotes	Embley & Martin '06; Rodrigues-Oliveira et al. 2022	
14	M 4/20	18	Extinction and the Fossil Record	TBA	
	W 4/22		**Exam 3 (through remaining lectures)**		

Homework Schedule

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