BIOLOGY 3 (BILD 3)
ORGANISMIC AND EVOLUTIONARY BIOLOGY

WINTER 2016

TU-TH 8:00-9:20, PETERSON 108

OUTLINE OF COURSE

Christopher Wills
5256 Muir Biology
X44113, cwills@ucsd.edu

Office Hours: Tu 9:30-11:00, Th 10:30-12:00
(or by appointment)

This course deals with the living world at the level of populations and ecosystems. It is designed to introduce students to the fields of evolution, systematics, ecology and behavior.

These fields lie at the heart of biology, because they deal with the mechanisms that explain the origin and maintenance of the diversity of life. And they will also, during your lifetimes, lie at the heart of public policy and decision-making. During your lifetimes you will face the consequences of global warming, overpopulation, and mass extinctions, and it is essential as scientifically educated citizens that you understand the origins and consequences of these changes to our planet.

The first part of the course will deal with evolution, since an understanding of the evolutionary process enables us to grasp why there are so many different kinds of living things. We will explore how species form, how evolution has often brought about large changes in body plan, and how species (including ourselves) have evolved and are likely to continue to evolve. We will examine the evolution of behaviors, and show how many behaviors have a substantial genetic component. Drawing on these fundamental evolutionary and genetic principles, we will then turn to the basic principles of ecology that govern how populations grow and compete, and how groups of species interact. We will see how evolutionary and ecological processes have together shaped the planet, and how the interactions between different species can produce complex ecosystems. Throughout the course we will explore the effects that our own species has had on the process of evolution and on the planet's biosphere, as we change the climate and alter the world's ecosystems.

PREREQUISITES: There are no official prerequisites for this course, but you may have trouble unless you have had at least a good biology course in high school. You can get away without such preparation only if you are willing to do some extra work. **It is essential that you know the rules of Mendelian genetics, that you understand mitosis and meiosis, and that you know the basics of molecular biology — how genetic information is transferred from DNA to RNA and then to protein**. If you don't, you will need to do some extra reading in Units 1 and 2 of the text and attend the workshops that the IAs will conduct in section. Don't be afraid to ask questions!

ATTENDANCE AT LECTURES: I must apologize that the lectures start at such an early hour. But I encourage you to attend them nonetheless. An extensive review of the literature (Crede M., Roch S. G., Kieszczynka U. M., Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance with Grades and Student Characteristics. Review of Educational Research 2010; 80(2): 272-295) has shown that class attendance is strongly correlated with academic success. Why sacrifice your GPA for an extra hour of sleep?

WEB SITE: You will need a username and password to get to the BILD 3 web site. Most of you have one already, and will be able to access the TritonEd site. If you cannot access the site, please get in touch with ACS in the Muir AP&M building.

What is on the web site? You should go first to the contents page. There the notes for each class, arranged by lecture, will be available a day or two after each lecture. The notes will include copies of the slides that are shown during the class. You can download them as a PDF file and read them in Adobe Acrobat or Acrobat Reader. Before the midterm and final, some sample questions from old exams will be posted. Announcements of exam room changes and many other matters will be posted at the head of the site. Check the site often!

There will also be an online discussion board on the site, moderated by the IAs. You can ask the IAs questions, make comments, and discuss interesting matters that come up in class. **Please confine your contributions to the discussion board to matters directly relevant to the course material.** And please check to see whether your question has already been answered before you post it. If you want to post an answer to a question, be sure to check with your IA first so that you are confident you are right and don't lead everybody astray.

MIDTERM: Thursday Feb. 4, in Peterson 108 (and in additional rooms to ensure alternate seating) at 8 am.

FINAL EXAM: Thursday March 17 8-11 am (room to be announced).

APPORTIONMENT OF GRADES: The midterm will count 30%, the final 50% and the section quizzes 20% of your grade.

SECTIONS:

ATTENDANCE AT A SECTION IS MANDATORY FOR THE CLASS.

THERE WILL BE NO SECTIONS DURING THE FIRST FULL WEEK OF CLASSES. SECTIONS START THE WEEK OF MONDAY JANUARY 11.

There are three main purposes to the section meetings.

a) Some time in each section will be devoted to questions and answers dealing with material in the readings or in the lectures. There is additional material in the text readings that are listed below that will not be covered in the lectures, so be sure to read the material thoroughly so that you can discuss it in sections!

b) Five twenty-minute quizzes will be given during the quarter in the section meetings. **NOTE THAT THERE WILL BE A SHORT-ANSWER QUIZ DURING THE FIRST SECTION MEETING, WHICH TAKES PLACE DURING THE SECOND WEEK OF CLASSES. THE QUIZ WILL COVER THE FIRST WEEK OF CLASS MATERIAL AND READINGS, SO COME PREPARED!** Remember that the five quizzes during the quarter count for a total of 20% of your grade, so do not treat them lightly. **BE SURE TO TAKE YOUR QUIZZES AT THE PROPER TIME AND PLACE! NOTE THAT <u>UNLESS YOU HAVE OBTAINED PRIOR PERMISSION, YOU WILL NOT BE PERMITTED TO TAKE A QUIZ IN ANOTHER SECTION!</u>** For each week that you delay taking a quiz (without a bona fide medical excuse), 25% will be subtracted from the quiz score. We have a liberal policy about makeups, but only if you let your IA know about any medical or family problem as soon as possible.

c) At intervals during the quarter the IAs will conduct workshops covering basic information that you need in the course. If you are unsure about the difference between mitosis and meiosis, or DNA and RNA, be sure to come to these sessions!

SECTION TIMETABLE:

Week of:	
Jan 11	Quiz
18	Workshop on basic genetics (note there is a holiday on Monday, so students in Monday sections must attend another section)
25	Quiz
Feb 1	Workshop on geological timetable
8	Quiz
15	Review of course material (again there is a holiday on Monday, so students in Monday sections must attend another section)
22	Quiz
Mar 1	Workshop on basic ecology
7	Quiz

COURSE TEXT: **Biology in Focus, Campbell (1st Ed. or 2nd Ed.)**

LECTURE OUTLINE (APPROXIMATE) AND CAMPBELL TEXT READINGS. (FOR THOSE OF YOU WITH THE SECOND EDITION I FINALLY GOT HOLD OF A COPY THE FIRST EDITION READINGS ARE MARKED C1, AND THE SECOND EDITION READINGS ARE MARKED C2.)

Lecture	Date	Topic
1.	Jan. 5	Scope of the course. Darwin and natural selection. History of the idea of evolution before Darwin. Darwin and the voyage of the Beagle. Characteristics of Darwin's theory. C1, pp. 7-14, C2 pp. 3-12
2.	Jan. 7	Natural and artificial selection. Some of the immediate consequences of and difficulties with the theory and how they were resolved. How genetics and Darwinian evolution were brought together in the Neo-Darwinian synthesis. C1, pp. 365-379, C2 pp. 413-423.
3.	Jan. 12	Components of the Neo-Darwinian Synthesis. The Hardy-Weinberg Law and factors that disturb Hardy-Weinberg equilibrium. C1 pp. 400-403, C2 p 417. Mutation and the types of mutation. C1 pp. 404-409, C2 pp. 248-249, 266-267.
4.	Jan. 14	Gene duplications and deletions and how genomes evolve. C1 pp. 392-395, C2 pp. 357-374. Natural selection and how it affects phenotypes. Examples of natural selection. C1 pp. 410-414, C2 pp. 424-430.
5.	Jan. 19	Selection that maintains polymorphisms: heterozygote advantage and negative frequency-dependent selection. C1, pp. 412-414, C2 p. 426. Random genetic drift. Drift examples. C1 pp. 407-408, C2 p. 421-422
6.	Jan. 21	Gene flow, including migration. Genetic recombination and how it can aid evolution. C1 pp. 407-412, C2 pp. 243-244.
7.	Jan. 26	Sexual selection. Genetic recombination and sexual selection. Sexual selection and selection for sexual dimorphism. Sexual selection and Bateman's rule. C1 p. 412-413, C2 p. 427.

8.	Jan. 28	Speciation. Definitions of species. Speciation and adaptive radiation. The genetics of speciation. Speciation in African cichlids. C1, pp. 418-422. Allopatric and sympatric speciation. C1, pp. 423-429, C2 pp. 434-449.
9.	Feb. 2	The history of life. The universal tree of life. C1, pp.436-440, C2 p. 395. Phylogenetic trees and what we can learn from them. C1 pp. 381-395, C2 pp. 395-409.
	Feb. 4	MIDTERM
10.	Feb. 9	The early history of living cells. The fossil record. C pp. 458-475 Symbiotic interactions, including mutualism. The invasion of the land. The alternation of generations. The Cambrian radiation and its possible causes. Origins and characteristics of the major eukaryotic phyla. C1 pp. 481-500, C2 pp. 452-470
11.	Feb. 11	A survey of plant and animal diversity. C1 pp. 504-548, C2 pp. 497-540. Macroevolutionary changes. Homeobox genes and other genes that affect development. The evolution of stickleback fish and of animal eyes as examples of macroevolutionary change. C1 pp. 430-433, 353-360, C2 pp. 465-468, 371-374.
12.	Feb. 16	Behaviors. Types of behaviors, the genetics of simple behaviors and how such simple behaviors evolved. C1 pp. 792-806, C2 pp. 814-835. Altruistic behaviors. Kin selection and reciprocal altruism. C1 pp. 809-813, C2 pp. 831-835. Game theory and behavior. How and why territoriality evolved. Not referenced in text — readings will be provided.
13.	Feb. 18	The evolution of humans. Primate and hominid evolution traced through the fossil and molecular records. C1 has an unbelievably brief mention on p. 546! C2 has some bits here and there: pp. 357, 373, 568. Additional readings will be provided.
14.	Feb. 23	ECOLOGY. Biomes and ecosystems. How biomes change over time. Ecological terms. Ecological niches and their definitions. C1 pp. 818-831, C2 pp. 840-862. Succession and climax communities. C1 pp. 856-858, C2 pp. 878-880. Energy cycles and trophic levels. C1 pp. 864-871, C2 pp. 892-898.

15.	Feb. 25	Exponential and logistic population growth. r and K selection. Competitive exclusion and demographic transitions. C1 pp. 832-838, C2 pp. 857-862.
16.	March 1	Competition within ecosystems and trophic structure. Components of ecological niches. C1 pp. 845-855, C2 pp. 867-877.
17.	March 3	Maintenance of biodiversity. Quantifying competitive exclusion – the conditions for coexistence of species. Host-pathogen interactions and their role in the maintenance of diversity. C1 pp. 839-840, 856-861, C2 pp. 867-872.
18.	March 8	The carbon, nitrogen and water cycles and how they shape the Earth and its climate. C1 pp. 872-878, C2 pp. 895-898.
19.	March 10	Conservation and restoration ecology. C 1 pp. 882-893, C2 pp. 912-917. Final topic: a glimpse of our future. C1 pp. 895-903, C2 pp. 926-929.