

# BIOL 4400: Evolution

*“Nothing in biology makes sense except in light of evolution”*

– Theodosius Dobzhansky (1973), geneticist & zoologist

## I. General Information

Professor: Dr. Kenneth Schoenly

Office: N271

Phone: 667-3949

Office Hrs: MW 9-10:30 (and by appointment)

Semester: Fall 2015

Credits: 3

Class: MWF 8:00-8:50 (N322)

Email: [kschoenly@csustan.edu](mailto:kschoenly@csustan.edu)

## II. Student Learning Goals:

1. Students will be able to distinguish between different processes (with evidence and examples of these processes) that lead to evolutionary change in organisms (i.e., natural selection, mutation, recombination, gene flow, genetic drift, sexual selection).
2. Students will be able to communicate the relevance of evolution to health, agriculture, forensic science, conservation, human origins, & even thoughtful consumerism.
3. Students will be able to communicate examples of evidence for evolution from genetics, biogeography, paleontology, comparative anatomy, biochemistry, molecular biology & physical anthropology.
4. Students will be able to construct an historical timeline of people, places & events that shaped understanding & development of the modern theory of evolution & its processes.
5. Students will be able to demonstrate knowledge of relationships between evolution & biological diversity through scientific understanding of common ancestors & phylogenetic relationships of fossils & living organisms (i.e., “tree thinking”) and speciation events.
6. Students will have enhanced understanding of the peer-reviewed literature in science, its decentralized, cumulative, self-correcting, & hypothesis-testing features, & be able to distinguish it from pseudoscience, such as “creation science” & intelligent design.

**“Anyone is free to believe whatever they wish. But why train to become a biologist, or a doctor, when you deny the very foundations of your subject?”**  
- Dr. Steve Jones, Geneticist, University College, UK

## III. Course Description

(Catalog Description): Mechanisms and patterns of evolutionary change in populations and species, from molecular to geographical, over recent and geologic time scales. Prerequisites: BIOL 3350 (Lecture 3 hours) (Spring and Fall).

Evolution is *the* central and unifying principle of modern biology and is an experimental, observational, mathematical and correlative science. While evolution is integral to most biology courses in our curriculum, no single course covers this essential topic in its entirety. Moreover, one semester is not enough time to explore all aspects of evolution, so we will explore major concepts, hypotheses, experiments and case studies to understand and investigate mechanisms of evolutionary

change (i.e., natural & sexual selection, mutation, recombination, genetic drift, gene flow). Because BIOL 3350 (Introductory Genetics) is a pre-requisite for this class (and the freshmen biology sequence is a pre-requisite for genetics), **you have been given a handout** that reviews terms and topics that were covered in those classes. Because I will not review them again here, it is your responsibility to review/recall them (questions could appear on future exams).

An integral goal of this course is your continued development of critical thinking, written and verbal communication, quantitative reasoning, and experimental design skills. Lectures, homework assignments, in-class demonstrations, and videos will guide you in the development of these skills. Readings will be drawn from two sources, namely, the textbook and the primary literature (journal papers). **I will assume you have read the associated material listed in the schedule prior to coming to class and I may call on you to answer questions and participate in discussions.**

Students who are physically present, but inattentive (including, but not limited to, sleeping, excessive conversation, texting, emailing, web-surfing, being disruptive, arriving late, leaving early, etc.) may be asked to leave. Repeat offenders will be turned over to the Dean of Students. Unexcused absences for gradable events will result in no score, but in the event of documented compelling circumstances, attempts will be made to work out conflicts prior to the absence. **Turn off all cell phones at or before arriving to class.**

#### **IV. Course Requirements**

The rigors of this course **demand regular attendance, commitment and concentration** to the readings and lectures. As per university regulations, students who are absent on the first class day will be dropped. **Graduate students who are enrolled in this class are expected to perform at a higher level than undergraduates (see handout); subsequently (and according to university policies), graduate students will receive additional assignments.** You will be introduced to the subject matter through organized lectures, some assigned readings (i.e., peer-reviewed journal articles), in-class demonstrations, videos, and trial transcripts. Your required textbook presents evolutionary biology, not just as a collection of facts, but as an ongoing research effort. This text will constitute the largest fraction of the lecture material; the remainder will come from journal papers and video questions. Written exams and homework will require students to demonstrate clear communication skills, critical thinking, problem-solving (verbal and mathematical), and biological knowledge about evolutionary principles. **To succeed in this course, students must have a basic knowledge of cells, DNA, genetics, taxonomy, tree-thinking, and arithmetic (see handout).**

Allow at least 2 weeks for exams and homework to be graded and returned. Missed exams must be made up within two lecture days of the exam date and require prior approval from me. It is your responsibility to contact me in the event you miss an exam and provide me relevant documentation (e.g., letter from a physician) documenting your absence. The final decision to offer makeup exams rests with me. Unexcused absences for gradable events will result in no score, but in the event of documented compelling circumstances, attempts will be made to work out the conflict. I reserve the right to give surprise 'pop quizzes' should I discover the class has not read the lecture material and/or is unprepared.

Behavior that interferes with the instructor's ability to teach or grade, or the ability of students to benefit from instruction, will not be tolerated. Examples include: audible ring tones, repeated late arrivals, repeated early departures, irrelevant conversations, and inappropriate use of phones or

computers. Inappropriate behavior will be dealt with as severely as university regulations allow. Behavior that is not consistent with the Student Conduct Code – including any form of academic dishonesty (see below) – will result in immediate expulsion from the course, a failing grade, and a referral to the Office of Student Judicial Affairs.

**Executive Order 1037** (effective August 2009) allows students to only repeat a course twice and in which they have earned less than a C grade. Students are only allowed to replace the first 16 units they repeat; those reaching the 16 unit limit may repeat an additional 12 units, but the resulting grade is averaged with all other grades. **Students who are repeating this class will be given different problem sets than those given to first-timers.**

## V. Text/Materials

*Evolution, 3<sup>rd</sup> edition* (abridged version) by D.J. Futuyma (chapters listed in the schedule below; a cheaper loose-leaf version is available). Companion website: <http://sites.sinauer.com/evolution3e/>  
**Bring a calculator** as well as the book to class.

## VI. Grading Procedure

Three semester exams (**Mondays: Sept 21, Oct 26, Nov 30**) will be mixed format (short answer/essay, matching, graph interpretation, fill-in-the-blank). Questions for exams will come from the lecture notes, textbook, videos, in-class exercises, and homework. The final exam (**Monday, December 14, starting time is 8:30**) will be comprehensive over the entire class material. If you arrive late after other students have turned in their exams, you will be turned away, so leave early on exam days to ensure you will be on time. Traffic and/or car problems are not acceptable excuses for being late. **No extra credit will be offered beyond the points earned on exams and homework.**

Your active participation in class is expected. I expect you to **WORK INDEPENDENTLY** on homework assignments and on written exams. **Cheating in any form is inappropriate conduct and will be dealt with swiftly and severely according to Sections 41301 through 41304 of Title 5 of the California Code of Regulations” which includes expulsion, suspension and probation.**

|                                      |                   |
|--------------------------------------|-------------------|
| Lecture Exams (3 @ 100 points each)  | 300               |
| Comprehensive Final (1 @ 200 points) | 200               |
| Homeworks                            | 100               |
| <b>Total</b>                         | <b>600 points</b> |

A = 540-600, B = 480-539, C = 420-479, D = 360-419, F < 360 points. No +/- grading will be applied to your final grade.

Unless announced otherwise, homework will be due at the next lecture meeting (no exceptions) and may include spreadsheet (EXCEL) exercises, tree-thinking problems, concept critiques, website viewing/video streaming, and/or topics from a prepared list.

## VII. Recording Policy:

**Audio or video recording of classes (tape and digital format) is not permitted under any circumstances. If you do not intend to comply with this policy, please discuss this with the instructor or take another class.** An exception is made for students registered with Disability Resource Services, who are approved for this accommodation. In such exceptions, DRS students

will be asked to sign a “Recording Agreement” which disallows them from sharing recordings with other individuals unless approved by the DRS program.

### **XIII. Important Dates to Remember:**

|  |   |
|--|---|
| August 24: Classes Begin                         | November 11: Veteran’s Day, no class                |
| September 7: Labor Day, no class                 | November 26-27: Thanksgiving, no class              |
| September 21: Last day to ADD/DROP               | November 30: <b>3<sup>rd</sup> Lecture Exam</b>     |
| September 21: <b>1<sup>st</sup> Lecture Exam</b> | December 10: Last Day of Classes                    |
| October 13: Columbus Day, no class               | December 11: Reading Day (No Classes)               |
| October 26: <b>2<sup>nd</sup> Lecture Exam</b>   | December 14: <b>Final Exam</b> , starting time 8:30 |

### **IX. Tips for Success:**

This class has a reputation for being very demanding and time consuming. However, if you heed the following advice, it can be made easier, even more enjoyable:

- Attend and actively participate in lecture
- Review and preview relevant material before lecture
- Take good notes in class and review them often (i.e., 1:3 rule)
- Ensure neatness & legibility on all assignments and turn in homework on time
- Make use of the index and glossary in the book; also bookmark textbook resources and companion website (see below) in your browser
- Explore resources of companion website
- If you have questions, ask or come by during my office hours

Correct spelling and grammar, and good penmanship are necessary for effective communication. Poor spelling, grammar and penmanship are signs of intellectual immaturity and carelessness. Therefore, such lapses will result in lost points on exams and homework; illegible answers on exams and homework will receive no credit (i.e., If I can’t read it, it’s wrong).

### **X. Implied Contract:**

This syllabus serves as a contract between you and the instructors. Your continued enrollment in this class denotes your understanding of and agreement with the material in the syllabus. You are expected to retain this syllabus and keep it in your notebook or textbook to refer to during the semester.

## XI. LECTURE OUTLINE AND READING ASSIGNMENTS\*

| Week Beginning     | Lecture, etc.   | Reading(s) or Exam   |
|--------------------|---|----------------------|
| Mon, Aug 24        | Syllabus Review, Peer-Review, Historical Timeline   | F1                   |
| Mon, Aug 31        | Phylogenetics (“Tree Thinking”), Darwin’s Postulates  | F1, F2               |
| Wed, Sept 9        | Broad Patterns in the History of Life, Fossil Record, Transitional Fossils                    | F3, F4, F5           |
| Mon, Sept 14       | Fossil Record, etc. (cont’d), NOVA video clip: “Extinction!”, Review for 1 <sup>st</sup> Exam | F4, F5               |
| Mon, Sept 21       | <b>Exam 1</b><br>Geography of Evolution   | <b>Monday</b><br>F6  |
| Mon, Sept 28       | Geography of Evolution (cont’d), Mutations  | F8                   |
| Mon, Oct 5         | Phenotypic & Genetic Variation  | F9, F13              |
| Mon, Oct 12        | Genetic Drift   | F10                  |
| Mon, Oct 19        | Natural Selection & Adaptation, Review for 2 <sup>nd</sup> Exam                               | F11, F12             |
| Mon, Oct 26        | <b>Exam 2</b><br>NOVA video clip: “Evol. Arms Race”, Conflict & Cooperation                   | <b>Monday</b><br>F16 |
| Mon, Nov 2         | C & C (cont’d), Sexual Selection, NOVA clip: “Why Sex?”                                       | F15, 16              |
| Mon, Nov 9         | Species & Speciation  | F17, F18             |
| Mon, Nov 16        | Speciation (cont’d)   | F17, F18             |
| Mon, Nov 23        | Evo-Devo (Evol. Developmental Biology), Review for 3 <sup>rd</sup> Exam                       | F21                  |
| Mon, Nov 30        | <b>Exam 3</b><br>Creationism & Society, NOVA video: “Judgment Day: ID on Trial”               | <b>Monday</b><br>F23 |
| Mon, Dec 7         | Catch-up Week   |                      |
| Mon, Dec 9         | Review for Final (last class day)   |                      |
| <b>Fri, Dec 14</b> | <b>Comprehensive Final (starts 8:30 AM)</b>   |                      |

\*Reading assignments listed on the course outline above are for *Evolution* by Futuyma (F1, F2, etc.). Topic content and dates of coverage in the syllabus may be changed due to extenuating circumstances.

### Some Informative Web Resources on Evolution:

Anonymous (1994). *Talk Origins*. Web address: <http://www.talkorigins.org/>

Anonymous (2000). *The Evolution and Medicine Review*. Web address: <http://evmedreview.com/>

Cold Spring Harbor Laboratory (2000). *DNA from the Beginning*. Web address: <http://www.dnafb.org/>

Darwin, Charles (1859). *On the origin of species by means of natural selection, or the preservation of favored races in the struggle for life*. Web address: <http://www.literature.org/authors/darwin-charles/the-origin-of-the-species/> (also in our library).

European Society for Evolutionary Biology (publishes *Journal of Evolutionary Biology*, the European equivalent of *Evolution*). Web address: <http://www.eseb.org/>

Futuyma, D. 2013. *Evolution*, 3<sup>rd</sup> edition, website:  
<http://sites.sinauer.com/evolution3e/>

Geological Time Scale (UC-B) website:  
<http://www.ucmp.berkeley.edu/help/timeform.php>

Kitzmiller vs. Dover (2004-05) court case. Web address for court documents, etc:  
[http://www.talkorigins.org/faqs/dover/kitzmiller\\_v\\_dover.html](http://www.talkorigins.org/faqs/dover/kitzmiller_v_dover.html).

Mendel, Gregor. 1865. *Experiments in Plant Hybridization*. Web address:  
<http://www.mendelweb.org/Mendel.html> (also available in our library).

Movie “Expelled” exposed (NCSE rebuts false claims of creationists):  
<http://www.expelledexposed.com/>

National Center for Science Education (2000). *Defending the Teaching of Evolution in the Public Schools*. Web address: <http://www.natcensci.org>

National Academy of Sciences (1998). *Teaching About Evolution and the Nature of Science*. Web address: [http://www.nap.edu/openbook.php?record\\_id=5787](http://www.nap.edu/openbook.php?record_id=5787)

PBS Evolution Video Series (2003). *Evolution: A Journey into Where We’re From and Where We’re Going*. Web address: <http://www.pbs.org/wgbh/evolution/>

Society for the Study of Evolution (publishes *Evolution*, the international peer-reviewed journal of organic evolution). Web address: <http://cms.gogrid.evolutionssociety.org/>

Society of Systematic Biology (publishes *Systematic Biology*, the international peer-reviewed journal of biological diversity and its origins). Web address:  
<http://systbiol.org/>

Understanding Evolution (UC-Berkeley) website: <http://evolution.berkeley.edu/>