

# 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 9:00-10:30 (and by appointment)

Semester: Fall 2018

Credits: 3

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

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## II. Required Text/Clicker/Calculator (acquire before 2<sup>nd</sup> class day):

(1) Evolution, 4<sup>th</sup> ed. (abridged) by Futuyma & Kirkpatrick (chapters listed in the schedule below; a less expensive loose-leaf version is available). Companion website: <https://evolution4e.sinauer.com/>

(2) i>clicker (rental/used/new remotes available). Numerous pedagogical studies have shown that i>clickers improve student retention and learning. To receive both in-class participation and performance points, you are required to bring your remote every day and come to class on time. Register your remote online at <https://www1.iclicker.com/register-clicker/> and complete the fields: first name, last name, student ID, remote ID, etc. Questions will come from your readings and lecture notes; performance points are earned if questions are correctly answered. If you are late and miss the 1<sup>st</sup> question, you will forfeit points for that lecture. Using another student's i>clicker or using multiple remotes is a form of cheating and will be dealt with swiftly and severely according to the California Code of Regulations (see below).

(3) Calculator. For in-class use, doing homework, and for exams.

## III. 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, and 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,**

#### IV. 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 theme 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. 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 and chemistry sequences are pre-requisites for genetics), **you have been given a handout** (also on Blackboard) 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/refresh yourself (questions could appear on future exams).

An integral goal of this course is your continued development of critical thinking, written and verbal communication, and quantitative reasoning 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 ask you questions from this material.**

#### V. Course Requirements

The rigors of this course **demand punctuality and 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 (unless prior notification was made). **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, i>clicker questions, and homework will require students to demonstrate clear communication skills, neatness, 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, chemistry, and arithmetic** (see 1<sup>st</sup> day handout, posted on Blackboard).

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., doctor's note, jury summons, funeral notice) documenting your absence. The final decision to offer makeup exams rests with the instructor. **An unexcused absence for a gradable event will result in no score, but in the event of a documented compelling circumstance, an attempt will be made to work out the conflict.**

For your convenience, the syllabus and select handouts for this class will be posted online using Blackboard. Find the Fall 2018 Blackboard menu to access your course materials.

**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.**

## VI. Personal Responsibility

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, outbursts, repeated late arrivals or early departures, excessive or irrelevant conversations, being disruptive, and inappropriate use of phones or computers. Behavior that is not consistent with the Student Conduct Code – including any form of academic dishonesty (see below) – will result in disciplinary action. **At the start of class, turn off all cell phones. Check your university email daily for updates or information items.** Starting an email with “Hey” or no salutation is an inappropriate way to begin a professional conversation. Use email correspondence as an opportunity to practice your professional skills.

## VII. Grading Procedure

Three midterm exams (**Mondays: Sept 17, Oct 22, Nov 26**) will be mixed format (multiple choice, short answer/essay, matching, graph interpretation, fill-in-the-blank). Questions for exams will come from the lecture notes, textbook, videos, in-class activities, and homework. The final exam (**Wednesday, Dec 12, 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 extra 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 points earned on exams, homework, and clickers.**

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.**

|  |                |             |
|--|----------------|-------------|
| Midterm Exams (3 @ 100 points each)                        | 300            | 50%         |
| Comprehensive Final (1 @ 150 points)                       | 150            | 25%         |
| Homework   | 120            | 20%         |
| i>clicker questions (performance, punctuality, attendance) | 30             | 5%          |
| <b>Total</b>   | <b>600 pts</b> | <b>100%</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.

Each homework will have a due date and time and may include math problems and concept critiques, website viewing/video questions, and/or topics from a prepared list. **An unexcused absence for a gradable event will result in no score, but in the event of a documented compelling circumstance, an attempt will be made to work out the conflict.** Otherwise, homework that is turned in after the due date will not be accepted for credit.

### VIII. 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. Some Important Dates:

|  |   |
|--|---|
| August 22: Classes Begin                       | November 12: Veteran’s Day, no class        |
| September 3: Labor Day, no class               | November 22-23: Thanksgiving, no class      |
| September 17: 1st Lecture Exam                 | November 26: 3rd Lecture Exam               |
| September 19: Census Day: last day to add/drop | December 10: Last Day of Classes            |
| October 10: Columbus Day, no class             | December 11: Reading Day (No Classes)       |
| October 22: 2nd Lecture Exam                   | December 12: Final Exam, starting time 8:30 |

### IX. Tips for Success:

This class has a reputation for being demanding and time consuming. If you are not prepared to dedicate the time and effort needed for this course, you should reconsider your enrollment. However, if you heed the following advice, the class can be made easier and more enjoyable:

- Be punctual and attend every class meeting
- Review genetics and general biology notes to refresh memory
- Review upcoming material ahead of lecture
- Take good notes & revisit/rewrite often (1:3 rule), carefully ponder each i>clicker question
- Seek help from university tutors (Library, CVMSA “Commons”)
- Ensure neatness & legibility on all exams and homework and turn in on time
- Review terminology and concepts using the book’s index, glossary, and end-of-chapter summaries
- In browser, bookmark companion website; visit often
- If, after reviewing your notes & text, you need clarification or have questions, come by during my office hours or email me to make an appointment

Punctuality and regular attendance, correct spelling and grammar, and good penmanship are all necessary for succeeding in a professional career. Consequently, poor spelling, grammar or penmanship will result in lost points on exams and homework; illegible answers on exams and late 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     |
|----------------|--|------------------------|
| W, Aug 22      | Syllabus Highlights, How to Learn Evolutionary Biology, Historical Timeline, Principles & Processes of Evolution   | xvii-xviii, F1         |
| M, Aug 27      | Timeline & Processes (cont'd), NOVA clip: " <i>Isn't Evolution Just a Theory?</i> ", Darwin's Postulates, What Not to Expect From Natural Selection, Phylogenetics ("Tree Thinking") | F1, F2, F3, F16        |
| W, Sep 5       | Phylogenetics (cont'd), Age of the Earth, History of Life, Fossil Record & Transitional Fossils  | F2, F16, F17, handouts |
| M, Sep 10      | Biological Diversity, NOVA clip: " <i>Extinction!</i> ", Review for 1 <sup>st</sup> Exam   | F19, F20               |
| M, Sep 17      | <b>Exam 1 (Monday)</b><br>Geography of Evolution   | <b>Exam</b><br>F18     |
| M, Sep 24      | Geography of Evolution (cont'd), Mutations   | F18, F4                |
| M, Oct 1       | Phenotypic & Genetic Variation   | F5, F6                 |
| M, Oct 8       | Phenotypic & Genetic Variation (cont'd), Natural Selection & Adaptation, Guns, Germs & Steel clip: " <i>Animal Domestication</i> " and " <i>Types of Farmed Animals</i> "            | F3, F5, F6             |
| M, Oct 15      | Natural Selection & Adaptation (cont'd), YouTube clip: "Dmitry Belyaev and Fox Experiments", Review for 2nd Exam   | F3, F5                 |
| M, Oct 22      | <b>Exam 2 (Monday)</b><br>NOVA video clip: "Evol. Arms Race", Life Histories & Fitness   | <b>Exam</b><br>F11     |
| M, Oct 29      | Cooperation & Conflict, All About Sex, Sexual Selection  | F10, F12               |
| M, Nov 5       | Sexual Selection (cont'd), NOVA clip: " <i>Why Sex?</i> ", Species & Speciation  | F9, F10                |
| W, Nov 14      | Species & Speciation (cont'd)  | F9                     |
| M, Nov 19      | Speciation (cont'd), Evolution & Development   | F9, F15                |
| M, Nov 26      | <b>Exam 3 (Monday)</b><br>Evolution & Development (cont'd)   | <b>Exam</b><br>F15     |
| M, Dec 3       | Creationism & Society, NOVA video: "Judgment Day: ID on Trial"   | F22                    |
| M, Dec 10      | Catch-up Day, Review for Final (last class day)  |                        |
| W, Dec 12      | <b>Comprehensive Final (starts 8:30 AM)</b>  | <b>Final Exam</b>      |

\*Reading assignments listed on the course outline above are for *Evolution* by Futuyma & Kirkpatrick (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/>

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

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://www.evolutionsociety.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/>

### **Video Clips Shown in Class:**

NOVA Evolution “Isn’t Evolution Just a Theory?”: <https://www.youtube.com/watch?v=85diEXbJBik>

NOVA Evolution “Extinction!”: <https://www.youtube.com/watch?v=8hE3SXQg7e8>

Guns, Germs & Steel “Animal Domestication & Farmed Animals”:  
<https://www.youtube.com/watch?v=0edh5Itvhy8>

Dmitry Belyaev & Fox Experiments: <https://www.youtube.com/watch?v=0jFGNQScRNY>

NOVA Evolution “Evol. Arms Race”: <https://www.youtube.com/watch?v=NzaRQvJepPQ>

NOVA Evolution “Why Sex?”: <https://www.youtube.com/watch?v=JakdRczkmNo>

NOVA “Judgment Day: ID on Trial”: <https://www.youtube.com/watch?v=7HZzGXnYL5I>