

BIEB 150 Evolution

Lectures M through Th 9:30 pm to 10:50 pm PDT, Center Hall 222

Discussion sessions will be in Center Hall 220:

Discussion One A01 M and W 11:00-11:50am

Discussion Two. A02 M and W 12:00-12:50am

The IA is Chris Winters, cwinters@ucsd.edu, who will be glad to help you with procedural questions. The discussions can be followed remotely, and you should contact Chris if you need this option.

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| FINAL | 09/08/2023 | 8:0 am to 10:00 am, place to be announced. |
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Professor: Christopher Wills, 5256 Muir Biology, cwills@ucsd.edu

Prof's office hours 11:30am-1:30 pm Tu and Th in his Muir office

If you can't make office hours, email him for an appointment!

Text: Zimmer and Emlen, *Evolution: Making Sense of Life*, Roberts & Co., 3rd edition. The text is not required, but you will find it well-written, up-to-date, and helpful.

The course will be taught in person (with an option for remote learning)! It will be great to have in-person interactions between students and professor and IA's again. This kind of contact improves the learning experience and allows students to take part in discussions and clarifications of the material. Please try to take part if you can! Many studies have clearly shown that students who attend class do better than those who only attend virtually.

It is clear, of course that some students will, for a wide variety of reasons, be unable to take part in person in all or part of the course or that have special requirements. We stand ready to make accommodation for these situations.

The lectures, and the IA-led discussion sections, will be available as podcasts. Make sure that you know how to access them. They will also be added to the course home page on WebCT ("Canvas") in the form of .mov files, which can be played on your computer. These files are likelier to be easy to follow. In addition, extensive lecture notes, including most of the slides shown during lecture, will be posted as downloadable PDF's on the class site after the lectures, here on the course home

page. Enrollees in the class should now have access to the class web site — CHECK that you do! If you can't, get in touch with Biology Instructional Services:

<https://biology.ucsd.edu/administration/units/sis/index.html>

Important additional information about the course, such as practice exams, will also be posted on the class web page, so you should visit it regularly.

Some of you will not be able to attend in person, for at least some of the time. Coordinate with your IA about the mechanics of keeping up with the material, taking part in discussion sections, and taking exams.

Course Coverage;

The course will cover the field of evolutionary biology at a high level, and by the end of it you will feel comfortable reading and understanding papers from the current scientific literature. At the present time there is more active research about all aspects of evolution than ever been before, thanks to advances in molecular biology, paleontology, developmental biology, behavior, neuroscience, and many other fields. We will explore many of these exciting new advances, which are taking place almost daily. At the end of the course we will explore some of the biggest evolutionary questions of the moment: how do infectious diseases arise, change and spread, how have Covid-19 and other pandemic agents evolved, and how have we as a species evolved to defend against such infectious agents? We will find that the history of our defenses goes back at least a billion years.

We will begin with a thorough examination of the process of evolution and how it takes place. We will use a mathematical approach to investigate the rules that govern gene pools, and the influences that can change allele frequencies in populations. Calculus will not be required. However, to follow these discussions, you must already be familiar with basic principles of genetics, biochemistry and molecular biology, at the level taught in lower-division introductory biology classes such as the BILD 1-2-3 series.

At the end of each week (starting with week 2), the Thursday lecture will be devoted to a discussion of a paper from the current literature that I will post as a PDF on the class web site the week before. The papers will be a challenge to read at first, but remember that you can easily look on-line to find definitions of terms you don't understand. Wikipedia is especially good on scientific terms. Each of the four papers will deal with a current aspect of evolutionary research, and will introduce you to some of the newest techniques that can be applied to the resolution of questions and controversies in the field. I encourage you to come to the discussion prepared to talk about the assumptions of the papers, and to suggest testable hypotheses that might be used to check and extend the work that is presented in each paper. As an encouragement for your participation, remember that some of this material may easily find its way onto the exams...

In addition to the final exam on Friday Sept. 8, there will be one midterm, on Monday Aug. 21. The midterm will count 30% of your grade, and the final exam 60%, with the two quizzes in section counting for the remaining ten percent. Exam formats will have a variety of short-answer questions, questions that require calculations, and questions that test your understanding of the material rather than rote memorization. The final exam will emphasize the second half of the course, but it will include some questions from the first half as well.

There will be IA-led review sessions before the midterm and the final. An IA-led on-line discussion forum will also be available on the Canvas site. Please avail yourself of the forum, but check to make sure that your question has not already been answered. In-depth discussions of the material in the course, and of recent advances in evolutionary biology, are encouraged.

| Outline of lectures: | Text readings (Emlen and Zimmer, Evolution 3rd ed. 2020 or 4th ed. 2023, not required but helpful): |
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| Aug. 7 Darwinian and neo-Darwinian evolution. | Chapter 2 |
| Aug. 8 An introduction to phylogenetic trees | Chapter 4 |
| Aug. 9 The origins of genetic variation. Types of mutation. | Chapter 5 |
| Aug. 10 The Hardy-Weinberg Law and its exceptions | Chapter 6 |
| Aug. 14 Selection, random drift and gene flow | Chapter 6, Chapter 8 |
| Aug. 15 Mechanisms leading to gene substitution and polymorphism | Chapter 6 sect. 6-7 |
| Aug. 16 Linkage, genetic recombination and the evolution of sex | Chapters 7, 11 |
| Aug 17 Discussion of Paper 1 | |
| Aug. 21 MIDTERM | Chapter 10 |
| Aug 22. Adaptation | |
| Aug 23 Sexual selection and kin selection | Chapter 11.2-11.6 |
| Aug 24 Discussion of Paper 2 | |
| Aug 28 Game theory, behavior, and life history evolution | Chapter 16 |

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| Aug 29 | Speciation | Chapter 13 |
| Aug 30 | The basics of molecular evolution and the evolution of genomes. The fossil record. | Chapters 9, 3, 14 |
| Aug 31 | Discussion of Paper 3 | |
| Sept. 4 | LABOR DAY HOLIDAY | |
| Sept. 4 | Evolution and development, major evolutionary adaptations | Chapter 9 |
| Sept. 5 | Human evolution | Chapter 17 |
| Sept. 6 | The coevolution of diseases and of their hosts | Chapter 18 |
| Sept. 7 | Discussion of Paper 4 | |
| Sept. 8. | FINAL (location TBA) | |