

36-149 THE TREE OF LIFE  
COURSE DESCRIPTION AND SYLLABUS  
FALL 2006

---

Class Schedule:	TR 10:30-11:50 in Porter Hall A19C	<b>Vital Info</b>
Instructor:	Christopher Genovese 132H Baker Hall (x8-7836) genovese@stat.cmu.edu	
Office Hours:	By appointment	
Web Site:	<a href="http://www.cmu.edu/blackboard/">http://www.cmu.edu/blackboard/</a>	
Text:	An Introduction to Biological Evolution by Kenneth V. Kardong The Cartoon Guide to Genetics (updated edition) by Larry Gonick and Mark Wheelis plus selected readings	

---

The ultimate focus of this course is on understanding evolutionary relationships among organisms. We will learn to use data to build and interpret the evolutionary equivalent of family trees, called phylogenetic trees.

**Course Objectives**

By the end of this course, you will be able to

- Explain the components and mechanisms of evolutionary theory,
- Describe the evidence for evolutionary theory,
- Distinguish among evidence, theory, hypothesis, etc. also among theory of evolution, population change, and common descent
- Discuss the role of phylogenetic inference in scientific work,
- Define key concepts (e.g., characters, homology, monophyly, phylogenetic trees, cladograms), and
- Analyze phylogenetic data and construct phylogenetic trees.

The higher level goals of the course are to help you understand

- A. The role of data in science

- B. How phylogenetic data can lead to inferences about evolution, and
- C. Specific methods of phylogenetic analysis.

---

We will begin with a thorough introduction to the theory of evolution to provide an essential context for understanding phylogenetic inference. Then, through a series of case studies on specific classes of organisms (e.g., dinosaurs), you will get hands-on experience building evolutionary (phylogenetic) trees.

## Scope

The topics we will cover include the following:

- Body Plans
- Taxonomy, Classification, and Phylogeny
- Tree of Life and History of Evolution as an Idea
- How Science Works
- Populations and Genetics
- Natural selection:
- Other mechanisms
- Variation
- Species
- The theory of evolution
- Evidence for common descent
- Evidence for evolutionary mechanisms
- Sex
- Development
- Dinosaurs
- Overview of phylogenetic methods
- Cladistics
- Molecular characters
- Insects and snakes
- Whales
- Advanced techniques

---

During the course of the semester, we will cover some of the most interesting and challenging ideas ever considered. It is best not to do that alone. One of the design principles underlying this course is that to get the most out of the material we all benefit from discussing the ideas among ourselves, through both talking and writing. Doing so helps you understand the ideas better and can give you new perspectives that you might not have come upon so quickly. I'm aiming here to build a community, small and transitory but active and interesting, where each of us feels free to contribute our ideas, questions, and speculations.

To that end, my main objective is to have you think deeply about what we are discussing and to share your thoughts in well-reasoned arguments or well-posed questions or well-sourced speculations. In most cases, there will not be a "right" answer per se; instead, the focus will be on making solid interpretations, gathering sound evidence, and considering viable alternatives.

The main activities, therefore, are reading, speaking, and writing. Class participation and written work will be the main assignments. Exam questions will be of the same scope and length as the homework assignments. Finally, in the last three weeks of the course, you will work on a final project that ties together the themes we've been exploring.

Grading:

25%	Participation in class discussions
30%	Written work
25%	Two exams during the term (15% for best, 10% for other)
20%	Final Project

## Logistics

---

You will be assigned written work each week that is designed to help you deepen your understanding of the concepts we have covered and to provide practice thinking through your ideas and questions.

These writing assignments will give you good practice generally – in forming arguments and gathering evidence – and specifically, in preparing to do the kind of writing that will be expected on exams. I will

## Written Work

meet with each of you individually during the semester to talk over your progress and give you feedback on your written work. Of course, you can also arrange for us to meet anytime you have questions or concerns.

Consideration of your work for grading purposes will be based on the whole body of work you present across the semester rather than on one particular piece. The key criteria are that you demonstrate a good grasp of the material; that when you make an argument, you make it logically sound with good evidence presented to support your claims; that when you ask a question or offer a speculation, they be well thought out; and that your writing be clear and concise. None of these things can be expected right away – they are part of what you are learning here – and I expect to see steady improvement in all these areas throughout the semester.

Note that if you are discussing a source, you should cite that source properly. If the source is available on the web (e.g., website), it is necessary and sufficient that you refer link to that source explicitly by URL. This enables me to evaluate your interpretation of the source material. All work must be your own; University policies on plagiarism are in force. (See <http://www.cmu.edu/policies/documents/Cheating.html> for details.) In particular, if you quote material from another writer, you need to cite that source. Again, for web materials, an explicit Author and URL is sufficient citation.

---

There will be a reading assignment for every class, both to review or extend what we've talked about earlier and to prepare you for the day's discussions. It is important to do the readings as they come.

## Readings

One challenging aspect of reading material in the biological sciences is the terminology, especially the names of groups of organisms. There is some rhyme and reason to it, but it's not always readily apparent. I will try to guide you as to which terms are important to be familiar with and which are not. If you are unsure in any case, just ask. Also, the course web page will include links to a collection of good glossaries and definitions of other terminology we will use.

In addition to the regular readings that we discuss in class, you will select one book from a list I provide and read that book over the course of the semester. This book will be the source for some of your writing assignments and will likely play a role in your final project.

---

One of the best ways to cement your understanding of ideas is to talk about them. This is a “seminar” course, which means that class discussions are an essential part of the experience. What I’m looking for here is an effort on your part to contribute constructively to the discussion, a willingness to grapple with new ideas, and engagement with your classmates’ ideas.

## **Class Participation**

Besides contributing to the collective discussion, we will also engage in small group activities throughout the semester. Good participation in this context means playing an active role in your group and sharing what you have learned with the class as a whole.

---

There will be two in-class exams during the semester. Each will involve a short piece of writing or reasoning comparable to a moderate-length written assignment. The better of your two exam scores will count more toward your final grade. There will be no final exam.

## **Exams and Project**

During the last half of the semester, you will begin to develop a proposal for a final project. Work on the final project will take place during the last two to three weeks. The project will consist of either an essay related to your selected book or an analysis and interpretation of phylogenetic data.

---

As mentioned above, I will be meeting individually with each of you to discuss your writing. In addition, during the first two weeks of class, we will meet in groups of three or four to have a quick chat. I'll have a sign up sheet in class.

The easiest and most reliable way to get in touch with me is by electronic mail at the above address. Feel free to send mail at any time; I am often online at odd hours. I will respond as soon as possible, but it will not always be instantaneously. You can also call my office at the above extension or leave a message with either Margie Smykla (132L Baker Hall) or with Rose Krakovsky, the department receptionist (132 Baker Hall entry way).

If you would like to meet outside of class, let me know in class or by email and we'll set up a time. You are also welcome to stop by my office any time to discuss the class. Please understand that I may not be free to talk to you at that time, but, in that event, we can make an appointment for a later time.

I plan to have several special events during the semester, including a field trip and "movie night." I'll keep you posted about the details.

## Meetings and Miscellany