

# BIO 180 Theory of Evolution

Fall 2008  
TR 3-4:15 pm  
Trumbower 125

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*"Nothing in biology makes sense, except in the light of evolution."*  
— Theodosius Dobzhansky

In 1859, English naturalist Charles Darwin published the scientific masterpiece *Origin of the Species*. While he was not the first scientist to propose that life forms evolved from other life forms, he was the most articulate, comprehensive, and convincing advocate of the idea. Since that time, evolution has been the single most important paradigm for making biology systematic and predictive—in short, it was the critical theoretical insight that allowed biology to join chemistry and physics as mature sciences. It also put biology on a collision course with orthodox Christian theology, an issue that continues in the United States today (but generally not elsewhere in the world).

While the philosophical implications of evolutionary theory are massive (human beings could have come into being without the aid of a supernatural entity), the biological theory itself is not the same as its implications. For example, evolutionary theory explains the mechanisms by which life is diverse and changes over time, but makes no claims about the origins of life (counter to common rhetoric). Similarly, natural selection is not “hypothetical” in the common sense of the word—it is a reproducible quantitative certainty: we understand the mathematical rules that govern how organisms have and will change over time. Some of the confusion over evolution stems from conflating the theory with its broader implications and from misunderstanding (either through ignorance or willful manipulation) the true nature of the theory and the 150 years of evidence that support it. Both of those problems stem, in part, from a general lack of understanding about how science works and how scientists generate complex explanations such as evolution.

BIO 180 will address this central issue in biology and the American dialog about science by examining evolutionary theory in detail. We will view evolution through a “process-oriented” lens. While we will explain what evolution is (and is not), we will do so by examining the process used by scientists to derive and test the theory. We will learn how a scientific “theory” is very different from the casual use of the term. In particular, we will explore the important functions of observation, deductive and inductive logic, prediction, empirical design and interpretation, evidence, imagination, inspiration and story-telling. While discussing the tremendous explanatory power of evolution, we will also discover that science is not linear, mechanical, or necessarily logical.

## SCHEDULE

The basic schedule for the course is outlined here. We may deviate somewhat from this schedule over the course of the semester.

WEEK	TOPIC	READING	ASSIGNMENT
Aug 26	A mechanism for diversity: Defining evolution and science	1. Pigliucci (handout) 2. Campbell and Reece (handout) 3. Carey Ch. 1, 6 4. Zimmer Introduction (by SJ Gould)	
Sep 2	What makes it science? Aristotle and the sins of Galileo	1. Moore (handout) 2. Gingerich (handout)	Discussion
Sep 9	Lamarck's heresy: Paley, theory and geology	1. Moore (handout) 2. Zimmer pp 1-20 3. Zimmer Ch. 3	Discussion
Sep 16	Darwin's cruise: Observation and inspiration	1. Carey Ch. 2 2. Zimmer Ch. 1 3. Gould Ch. 2 (handout)	Discussion
Sep 23	Darwin's revolution: On the Origin of Species	1. Zimmer Ch. 2 2. Carey Ch. 3 3. Darwin (pdf)	Discussion
Sep 30	Darwin's legacy: A purposeless world?	1. Mayr (handout) 2. Gould Ch. 3-4 (handout) 3. Zimmer Ch. 13	Discussion
Oct 7*	<i>*In-class midterm on Tuesday, October 7*</i>		Mid-term Exam
Oct 14	Darwin's real black box: Genetics and mutation	1. Zimmer pp 85-91 2. TBA	In-class problems
Oct 21	Neo-Darwinism: Expanding and consolidating theory	1. Zimmer Ch. 4, 7 2. Gould Ch. 10, 12 (handout)	Discussion
Oct 28	Evolution in lab and field: Testing theoretical predictions	1. Carey Ch. 4 2. TBA	Discussion
Nov 4	The real battle of the sexes: Sex and evolution	1. Zimmer Ch. 10	Discussion
Nov 11	Very small invisible things: Selfish genes	1. Dawkins (handout)	Paper Due
Nov 18	But aren't we special? Human evolution	1. Zimmer Ch. 11, 12	Discussion
Nov 25*	HIV and SARS: Evolution and human disease	1. Zimmer Ch. 9	
Dec 2	Challenges for alternatives to evolution	1. Zimmer Ch. 13	Discussion
TBA			Final Exam

"Zimmer" and "Carey" refer to the two assigned texts, available for purchase in the bookstore. Other readings will be provided in class as handouts or via Blackboard as pdf or html files.

## **COURSE TEXTS**

Carl Zimmer, 2001, *Evolution: The Triumph of an Idea*, Harper Perennial, 2006 edition.

Stephen S. Carey, 2004, *A Beginner's Guide to Scientific Method*, Thomson Wadsworth, 3<sup>rd</sup> Edition.

Plus numerous in-class handouts and electronic readings distributed via Blackboard.

## **THE S PERSPECTIVE**

**"Physical and Life Sciences (S)**—an exploration of our current understanding of natural phenomena; a study of the methods employed to formulate a consistent set of explanations that are developed from and applied to experimental observations."

BIO 180 is intended for non-science majors and does not count toward the requirements for any major. It fulfills one of two "S" perspective requirements for all Muhlenberg College graduates. The course explores our current understanding of the mechanisms of biological diversity (natural phenomenon) and explicitly addresses the intellectual and experimental processes that were and are employed to develop this explanation.

## **GRADING AND EVALUATION**

Students will be assigned a grade for the course based on the following scheme:

- 20% Mid-term exam
- 25% Final exam
- 30% Term paper
- 10% Attendance
- 15% Participation

Grades will be determined using the familiar 10-point per letter grade scale. They are not negotiable. The following rubric should help you determine how your performance in attendance and participation will translate into a letter grade:

<b>GRADE RANGE</b>	<b>ATTENDANCE</b>	<b>PARTICIPATION</b>
A	No more than one absence for any reason	Regular and active questioning; insightful commentary
B	No more than three absences	Regular and/or thoughtful questions; occasional insights
C	No more than four absences	Occasional participation
D	No more than five absences	Rare and/or negative participation
F	No more than six absences	No or disruptive participation

## ***OFFICE HOURS***

My nominal office hours will be Tu 12:30-1:30, and ThF 9:30-10:30. I'm likely to be in my office or lab Tu and Th between 9:30 AM and 3 PM, and on Wednesday and Friday mornings. I will not be on campus most Mondays. I also encourage you to email me with questions or to make an appointment. Calling me is usually not a good option, unless it is a dire emergency.

## ***BLACKBOARD AND EMAIL COMMUNICATION***

Some lecture material, reading and assignments will be posted on-line using the Blackboard utility. Be sure that you know how to use Blackboard and that you monitor course information on-line. I may also communicate with the entire class via email periodically. The Blackboard and Capstone utilities I will use send the email to your standard Muhlenberg email account. It is your responsibility to insure that you read (or regularly forward) your Muhlenberg email.

## ***COURSE POLICIES***

All assignments are due on the date indicated. Late assignments will result in a significant penalty. Each exam must be taken on the date and time scheduled. Exceptions to these policies will be allowed only in the case of serious illness requiring hospitalization or emergency room treatment, or family emergency. All exceptions must be pre-approved by the instructor and documented by a physician or other official.

Cheating will not be tolerated in any form. All written work handed in for this course must be your own. You may discuss assignments with your peers or me, but the written work submitted must be your work alone. Plagiarism will be taken VERY seriously and is potentially a major problem in a class of this sort. Please review what constitutes plagiarism (for example copying someone else's idea without proper attribution) and write carefully when you are working close to your sources.

Attendance is required at every class. If you cannot attend a particular class, it is your responsibility to obtain notes from a classmate. If you expect to miss more than one or two classes, who should discuss with me whether this class is appropriate for you to take this semester.

It is important that students with documented disabilities discuss appropriate accommodations with me as soon as possible.