



# Evolution: Facts, Theories, & Hypotheses

## Fall 2016

**TuTh 10:10AM – 11:00AM**

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Office Hours: TuTh 11:00AM – 12:00PM or by appointment.

### **Course Description**

Evolution is one of the most fundamental, ubiquitous, and controversial topics in biology. This course is an introduction to evolutionary theory, designed for early undergraduates in any field. It is a requirement for all freshmen in Biology majors and is a pre-requisite for several higher level biology courses, such as Ecology, Animal Behavior, and Entomology

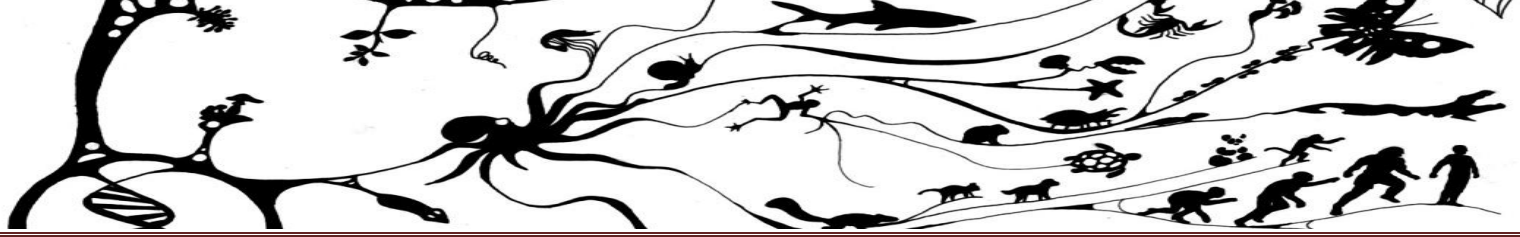
Over the course of the semester, we will explore three major themes:

#### *1) Evolutionary evidence, patterns, and processes*

Darwin is the most famous scientist associated with Evolutionary theory; however, he is not the only scientists to have contributed to our accumulated knowledge. We will discuss major contributions from other scientists and the accumulation of evidence that allowed Darwin to formulate his theory of Natural Selection. We will also cover major contributions in advancing Evolutionary theory since Darwin by examining the patterns that arise as a result of evolution and the processes that govern those patterns.

#### *2) Evolutionary theory's predictive power and applications*

Evolutionary theory is critical to understanding many aspects of biology because it has the predictive power to explain many disparate biological phenomenon. We will cover some of the most famous examples of evolution and delve into the scientific literature on evolutionary research. The concepts that we cover in class will form the foundation for all your future exploration of biological topics. We will also discuss the importance of systematics and cover the basics of taxonomy, nomenclature, and phylogenetics through lectures and assignments.



### 3) *Evolution in society and culture*

The concept of evolution is used in many contexts in our culture, from technological advancement to science fiction, but many of these examples get the basics all wrong. There are many common misconceptions about evolution in our society that we will identify and address. As evolution can be an incredibly controversial topic, it is important to be able to rationally discuss the assumptions, strengths, and weaknesses of the arguments surrounding the topic. Through in-class discussions and debates, we will develop our scientific literacy and the strategies to effectively communicate scientific concepts to others.

### **Course Goals and Outcomes**

The goal of this course is to provide all students with the necessary skills to discuss, analyze, and evaluate cultural uses, arguments, and scientific literature about the theory of evolution. I aim to provide students with foundational knowledge on the evidence, patterns, and processes of evolution; the predictive power and applications of evolution; and the use of evolution in society and culture. By the end of the course, you will be able to:

- 1.1) Find, summarize, and critique scientific literature on the topic of evolution
- 1.2) Discuss the history of evolutionary thought by describing the major contributions of different scientists
- 1.3) Compare and contrast the major processes that contribute to evolution
- 2.1) Apply the basic principles of systematics to appraise literature and create a basic phylogeny
- 2.2) Analyze the importance of evolution to all aspects of biology
- 3.1) Critically evaluate evidence for and against evolution by identifying the assumptions, strengths, and weaknesses of the arguments.
- 3.2) Identify common misconceptions about evolution and formulate strategies to correct them

### **Grading Policy**

Final grades will be determined according to the following scale:

- A- 90-93%, A 94-97%, A+ 98-100%
- B- 80-83%, B 84-86%, B+ 87-89%
- C- 70-73%, C 74-76%, C+ 77-79%
- D- 60-63%, D 64-66%, D+ 67-69%
- F <60%

If you have a question about your grade on any assignment, please make an appointment to discuss it with me outside of class. If you dispute a grade on any assignment, please submit a written description of the issue and make a case for why you believe the grade should be altered with reference to the assignment guidelines and grading rubric. I will consider your request and meet with you to discuss my decision. Requesting a reassessment of your work will never result in a lower grade on the assignment in question.



### Assignments

Below is a table with a short description of all assignments in this class and their due dates. For each assignment I will post a document on the course website describing the guidelines and grading rubric for the assignment. Late assignments will not be accepted without a valid reason.

Assignment	Short Description	Points	Due Date	Learning Outcome Assessed
In-class writing assignments and clicker questions	Multiple choice clicker questions and think-pair-share exercises in class to be turned in for evaluation.	15	Throughout semester	1.2, 1.3, 2.2, 3.1, 3.2
Evolutionary Scientist Biography	A short biography of a scientist who made a significant contribution to evolutionary theory	5	Week 3: Th	1.2
Evolution Paper Summary	A summary of a scientific paper about evolution	5	Week 4: Th	1.1, 1.3, 2.2
Evolution Paper Critique	A critique of a scientific paper about evolution	10	Week 6: Th	1.1, 1.3, 2.2
Evolution Paper Evaluation	A summary and critique of a scientific paper about evolution	15	Week 9: Tu	1.1, 1.3, 2.2
Phylogeny Assignment	A phylogenetic analysis of a group of organisms from coding characters, and building a phylogeny, to naming and descriptions of species.	20	Week 12: Tu	1.1, 1.3, 2.1, 2.2
Phylogeny Poster	A scientific poster describing the methods and results of your phylogeny assignment.	10	Week 14: Tu	1.1, 1.3, 2.1, 2.2
Debate	A debate over the evidence for and against evolution.	20	Week 15: TuTh	2.2, 3.1, 3.2
Common Misconception Correction	An evaluation of a misconception about evolution in popular media and a reinvention of that media with the misconception corrected.	3	Week 15: Th	3.1, 3.2

### Extra Credit

There is one opportunity for extra credit in this course. The “Common Misconception Correction” Assignment can be completed at any time during the course for up to 3% extra credit. The assignment guidelines and rubric are on the course website. The last day to hand in this assignment is the last day of classes.



### **Textbooks and Resources**

There is no required textbook for this course; however, if you are interested in purchasing a book on this subject, there are several excellent texts available. Here are several that I recommend:

- Douglas J. Futuyma. 2013. *Evolution*. 3rd Edition. Sinauer Associates.
- Jon C. Herron and Scott Freeman. 2013. *Evolutionary Analysis*. 5th Edition. Benjamin Cummings.
- Carl Zimmer and Douglas J. Emlen. 2012. *Evolution: Making Sense of Life*. 1st Edition. Roberts and Company Publishers.
- Stephen C. Stearns and Rolf Hoekstra. 2005. *Evolution: An Introduction*. 2nd Edition. Oxford University Press.
- George C. Williams. 1996. *Adaptation and Natural Selection*. Princeton University Press.
- Richard Dawkins. 1986. *The Blind Watchmaker*. W. W. Norton & Company.
- Charles Darwin. 1859. *On the Origin of Species*.
- Charles Darwin. 1839. *The Voyage of the Beagle*.

There are also many online resources that discuss material covered in this class. In particular, I recommend:

- *Understanding Evolution*, <http://evolution.berkeley.edu/evolibrary/home.php>

### **Pre-Requisites**

There are no pre-requisites for this course, but it is a pre-requisite of several higher level biology courses, such as Ecology, Animal Behavior, and Entomology.

### **Course Website**

You can find course materials online via blackboard (<http://blackboard.cornell.edu/>). I will post lecture slides, handouts, and assignment guidelines. I also encourage you to use the discussion boards to discuss course materials with your peers.

### **Student Expectations**

I expect all students to not only attend lectures, but to be engaged with the material. Class discussions are much more productive for everyone if all students actively participate. The controversial nature of some of the material covered in this course may elicit strong reactions or opinions, but it is our responsibility to maintain rationale and civil discussions throughout the course. I support freedom of expression in this class; however, I will not tolerate contributions that degrade, abuse, harass, or otherwise silence an alternative viewpoint.



### **Communication Policy**

Generally, the best way to contact me is via email. Please only contact me from your university email address and treat all of our communication professionally. I treat all of my students with respect and expect to be granted the same courtesy. Please allow 24 hours for a response to your email and be advised that I do not respond to email after 8pm.

### **Digital Etiquette**

Please turn your cell phone to silent mode before you come to class. You are welcome to use laptops and other electronics in class, so long as you are not disturbing your peers. If your usage of electronics becomes a distraction to others, you will be asked to put them away.

### **Academic Integrity**

I expect all students to abide by the Cornell code of Academic Integrity that can be found here: <http://cuinfo.cornell.edu/aic.cfm>. Please familiarize yourself with these guidelines and if you have any questions about what constitutes a violation of the code, please get in touch with me so that we can discuss it further. Any infractions will result in a grade of zero for that assignment, and the appropriate administrators will be notified.

### **Diversity Statement**

“Cornell University is a community of diverse people, respectful and appreciative of difference. A commitment to diversity, central to the university’s founding vision, remains a core value of Cornell. Cornell recognizes that learning, discovery, creativity, and the innovative dissemination of knowledge benefit tremendously from the full participation of individuals with diverse points of view, coming from varied life perspectives.” -President Skorton

Part of the aim of this course is to familiarize you with biological and cultural diversity with regards to evolution. As such, I expect everyone to show respect for the different backgrounds, experiences, beliefs, and values expressed by any member of this class. I ask you to kindly refrain from making derogatory comments about other individuals, cultures, or groups. Find out more about Cornell's commitment to diversity here: <http://diversity.cornell.edu/>.

### **Accommodations Statement**

Student who may require special accommodations in this class are encouraged to contact both the Disability Service Center, and myself by the first week of class to ensure that we have time to implement any necessary accommodations.

### **Disclaimer**

I reserve the right to modify this syllabus and its contents throughout the semester as unexpected circumstances arise. I will always endeavor to give students advance notification of any changes.



### Tentative Schedule

Week	Class	Topic	Due
1	Tu	Introduction to the course	
	Th	What is Evolution and why does it matter	
2	Tu	History of Evolutionary Thought	
	Th	Darwin and the evidence for Evolution	
3	Tu	History of Systematics	
	Th	Mechanisms of Evolution	Evolutionary Scientist Biography
4	Tu	Natural Selection Pressures	
	Th	Sexual Selection	Evolution Paper Summary
5	Tu	Kin Selection and Group Selection	
	Th	Mutation	
6	Tu	Population Genetics and Gene Flow	
	Th	Molecular Evolution	Evolution Paper Critique
7	Tu	Genetic Drift	
	Th	Systematics and Taxonomy	
8	Tu	Nomenclature	
	Th	Phylogenetics	
9	Tu	Descent with Modification	Evolution Paper Evaluation
	Th	Macroevolution vs. Microevolution	
10	Tu	Rates of Evolution	
	Th	Fossils and Extinction	
11	Tu	Species Concepts	
	Th	Speciation	
12	Tu	Mechanisms of Reproductive Isolation	Phylogeny Assignment
	Th	Mechanisms of Reproductive Isolation	
13	Tu	Biogeography	
	Th	Co-evolution	
14	Tu	Poster Session	Phylogeny Poster
	Th	Common Misconceptions about Evolution	
15	Tu	Evolution in Society	
	Th	Debates	Debate
16	Th	No Final Exam	Common Misconception Correction