Syllabus for Biology 394
Evolution

Nothing in biology makes sense… except in the light of evolution.

Theodosius Dobzhansky

Instructor: Dr. Frank T. Kuserk
323 Collier Hall of Science
Office phone: (610) 861-1429
Home phone: (484) 281-3826
Cell phone: (215) 915-0375
e-mail: kuserk@moravian.edu

Office Hours: MW 1:00 – 2:00 and by appointment

Classrooms: Lecture – 204 Collier Hall of Science; MWF 11:45 AM - 12:35 PM
Lab –206 Collier Hall of Science; F 1:15 PM – 4:15 PM

Course Description:

For more than a century evolution has been the unifying theory of biology. From Charles Darwin's publication *On the Origin of Species by Means of Natural Selection* in 1859, through the development of the Modern Evolutionary Synthesis during the first half of the 20th century, to current theories on the mode and tempo of evolutionary change, evolutionary biology has played a key role in our understanding of how the natural world functions and changes over time. This course will explore evolutionary biology from several aspects, including the development of evolution as a theory, the importance of population genetics and natural selection as elements of evolutionary change, and the roles of reproductive isolation and hybridization on the origin of species. An emphasis will be placed on current evolutionary concepts and ideas such as the theory of punctuated equilibrium, the neutral theory of molecular evolution, and mosaic evolution. Discussions of major evolutionary trends, including the origins of humankind, will complete the course. Laboratory exercises, computer simulations and field trips to museums will focus on examining evidence for evolutionary principles.

Course Objectives:

Upon completion of this course students will be able to:

1) **Understand the Principal Mechanisms of Evolution.** Students will understand how the mechanisms of microevolutionary change (genetic drift, gene flow, mutation, sexual selection and natural selection) create, maintain, and destroy genetic variation and have

resulted in the remarkable diversity of life forms present today. Also, students will learn that these microevolutionary mechanisms affect ongoing ecological processes and can explain many current interactions among organisms.

2) **Understand the Major Evolutionary Trends in Biotic Diversity.** Several major evolutionary trends occurred during the history of life on Earth (e.g. often increasing complexity – but not always, evolution of predation, colonization of land, etc.). Students will understand (i) what constitutes a major evolutionary trend, (ii) the concept of macroevolution, (iii) the role of natural selection in molding key traits, and (iv) the pathways along which life forms "progressed" within the major phyletic lineages.

3) **Understand the Evolutionary Origin of Life.** A common evolutionary ancestry interconnects all life forms on Earth. Students will understand the theory of how life evolved on Earth and diversified into the variety of forms we see today.

4) **Understand How to Investigate and Model the Dynamics of Evolutionary Change in Ecological Systems (Populations and Communities).** Students will improve their skills at applying the scientific method to investigating, modeling, and understanding evolution in simulated populations and communities.

5) **Understand the Principles of Phylogenetic Systematics and the Methods of Bioinformatics.** Bioinformatics is one of the fastest growing fields of biology. Huge advances are being made as entire genes and genomes are being sequenced and shared. Although the principal goal of many of these efforts is in applied biomedical, agricultural, or environmental research, exciting and new insights are emerging about evolutionary relationships among organisms at all taxonomic levels. In this course, students will model these techniques and pose and test hypotheses about evolutionary relationships among organisms.

6) **Improve Scientific Thinking Skills Including Systems Thinking and Reflective Judgment.** Systems thinking approaches complex problems from an holistic rather than a reductionist perspective. Reflective judgment extends evidence-based thinking to the analysis of problems such as the complex challenges facing the sustainability of our global society today. These skills will be developed throughout all activities in this course.

7) **Understand the Uses and Effects of the Theory of Evolution in Society.** Evolutionary knowledge is at the fore-front of the biological revolution that has characterized the past several decades, and will likely dominate biology, medicine, and policy for the rest of this century. For example, biotechnology is now being used to manipulate the genome to improve our domesticated plants and animals (genetic engineering), our environment (bioremediation), and ourselves (numerous desirable examples such as gene therapy, but some much less so such as eugenics). In addition, evolutionary theories have been and continue to be brought into social debates to sometimes explain social behavior (sociobiology) but often to justify racism, social injustice, or even cultural genocide. Finally, recently the theory of evolution has come under vigorous attack by those who proclaim themselves to be "creation scientists" or

proponents of "intelligent design" and demand access to public school science curricula. No course in evolution would be complete without an exploration of the non-scientific belief system that these critics advocate.

Text: Bergstrom, Carl T. and Lee Alan Dugatkin. 2012. *Evolution*. W.W. Norton & Company, NY.; ISBN 978-0-393-92592-0 (Hardcover) or ISBN 978-0-393-91341-5 (Paperback).

Grading: The grading system is as follows:

A	=	93.0-100.0	C	=	73.0-76.9
A-	=	90.0-92.9	C-	=	70.0-72.9
B+	=	87.0-89.9	D+	=	67.0-69.9
B	=	83.0-86.9	D	=	63.0-66.9
B-	=	80.0-82.9	D-	=	60.0-62.0
C+	=	77.0-79.9	F	=	59.9 and below

Assessments:	
Lecture Exam I	15%
Lecture Exam II	15%
Lecture Exam III	15%
Final Exam	15%
Research Paper	10%
Laboratory Assignments	30%
	100%

Guidelines for Written Assignments:

1) Written work in the A range is based on an original, logical and coherently organized set of ideas; it makes a clear and persuasive argument (even if the reader disagrees with its argument); it brings in specific, relevant examples to back up its assertions; its points, at each turn, are clearly articulated: the words carry precise meaning, they don't obscure it; its sentences use only the words their ideas require, not anymore; its paragraphs have distinct though related roles in the essay's cohesion as a whole, each holding one thoroughly asserted idea (not two competing ideas, not one idea half-asserted); if appropriate it accurately and thoughtfully uses other sources; and its sentences are without the grammatical, spelling, or typographical mistakes that exacting proof-reading would catch. (All of this takes a lot of work. If it is all very nearly accomplished, the essay usually earns an A-.)
2) Written work in the B range: a very good paper, the writing of which is clearly, thoughtfully, and effectively executed. What sometimes prevents an "A" is a lack of originality, thorough thinking or careful proofreading. If two of these virtues are absent and the other areas of the paper are strong, the essay will usually earn a B-.

3) Written work in the C range: some conspicuous flaw usually earns an essay a C; its argument is really underdeveloped, it contains only minimal textual support, it has problems with organization and/or sentence clarity, it is in dire need of proofreading.

4) Written D work either contains more than one of the large problems cited in the "C" description or finds another way to convince its reader that the author has not spent nearly enough time on the thinking or writing in the essay.

5) Written work that earns an F misses on all criteria (originality, articulateness, persuasiveness, organization, the absence of mechanical mistakes).

Course Guidelines:

1. It has been my experience that students who do poorly in this course generally have numerous absences. I strongly suggest that you attend and participate in all lecture sessions unless you have a valid reason not to. I will maintain lecture attendance records and if I detect that you have excessive absences or are habitually late to class I will speak with you in private.

   An absence on an examination day will require either prior permission or a suitable excuse from a physician, the Health Center or Dean of Students Office before a make-up is given.

   Laboratory sessions, because they involve hands-on experiences that cannot be mastered effectively without performing them, are especially critical if one is to become a successful scientist. You are still required to complete any assignment associated with a laboratory in order to receive the points associated with that assignment.

   If you arrive late, be respectful by not disrupting a class already in progress.

2. All assignments are to be handed in by the due date on the syllabus or announced in class. Late work will be penalized; the instructor at his discretion will assess the penalty for any late work.

3. All students are expected to follow the principles of academic honesty as set out in the policies of Moravian College. See the Student Handbook for details. Any and all written work must be done in your own words (with the exception of direct quotations which are clearly indicated as such), and written work must include proper citations indicating the sources for any ideas, concepts, facts, or other information derived from others, whether or not you have restated it in your own words. Any cases of suspected cheating or plagiarism will be referred to the Academic Affairs Office. Academic dishonesty may result in a failing grade in the course.

4. In case of any crisis or emergency, or an extended absence from class, you must inform me either personally through Learning Services or the Academic Dean's Office.

5. Students who wish to request accommodations in this class for a disability should contact the Academic Support Center, located in the lower level of Monocacy Hall, or by calling 610-861-1401. Accommodations cannot be provided until authorization is received from the Academic Support Center.

6. These guidelines are intended for the benefit of the students as far as clarification of the instructor's expectations for the course; however, in exceptional circumstances the instructors reserve the right to exercise discretion in the application of these guidelines to individual cases or to refer a particular case to the Academic Dean if necessary.

Classroom Expectations:

1) Respect for others' answers and views.
2) Disruptive behavior during class will result in your dismissal from the class the first time, after that, disciplinary action will be taken.
3) Non-alcoholic drinks and non-odiferous foods are allowed in class; food that is especially odiferous is not permitted.
4) Attention to course related material only.

Evolution Lecture Schedule
Spring 2016

Day & Date			Topic	Reading*
M	Jan.	18	Early Evolutionary Ideas and Darwin's Insight	Chapters 1 & 2
W		20	Early Evolutionary Ideas and Darwin's Insight	Chapters 1 & 2
F		22	NO CLASS-Dr. Kuserk at the CEDD Conference	
M		25	Early Evolutionary Ideas and Darwin's Insight	Chapters 1 & 2
W		27	Natural Selection	Chapter 3
F		29	Natural Selection	Chapter 3
M	Feb.	01	Phylogeny and Evolutionary History	Chapter 4
W		03	Phylogeny and Evolutionary History	Chapter 4
F		05	Phylogeny and Evolutionary History	Chapter 4
M		**08**	**Exam I**	**Chapters 1-4**
W		10	Inferring Phylogeny	Chapter 5
F		12	Inferring Phylogeny	Chapter 5

Happy 207th Birthday, Charles Darwin!

Read Chapter 6, Transmission Genetics and Sources of Genetic Variation on your own.

M		15	The Genetics of Populations	Chapter 7
W		17	The Genetics of Populations	Chapter 7
F		19	The Genetics of Populations	Chapter 7
M		22	Evolution in Finite Populations	Chapter 8

W		24	Evolution in Finite Populations	Chapter 8
F		26	Evolution in Finite Populations	Chapter 8
M		29	The Origin and Evolution of Early Life	Chapter 11
W	Mar.	02	The Origin and Evolution of Early Life	Chapter 11
M		07	NO CLASS-SPRING BREAK	
W		09	NO CLASS-SPRING BREAK	
F		11	NO CLASS-SPRING BREAK	
M		14	**Exam II**	**Chapters 6, 7, 8, 11**
W		16	Major Transitions in Evolution	Chapter 12
F		18	Major Transitions in Evolution	Chapter 12
M		21	Major Transitions in Evolution	Chapter 12
W		23	Evolution and Development	Chapter 13
F		25	NO CLASS-EASTER BREAK	
M		28	Evolution and Development	Chapter 13
W		30	Species and Speciation	Chapter 14
F	Apr.	01	Species and Speciation	Chapter 14
M		04	NO CLASS-Dr. Kuserk at Power Plan Dialog, Harrisburg	
W		06	Extinction and Evolutionary Trends	Chapter 15
F		08	Extinction and Evolutionary Trends	Chapter 15
M		**11**	**Exam III**	**Chapters 12-15**
W		13	The Evolution of Sex	Chapter 16
F		15	Sexual Selection	Chapter 17

M	18	Sexual Selection	Chapter 17
W	20	The Evolution of Sociality	Chapter 18
F	22	The Evolution of Sociality	Chapter 18
M	25	The Evolution of Sociality	Chapter 18
W	27	Coevolution	Chapter 19
F	29	Coevolution	Chapter 19

Final Exam: Tuesday, May 3 from 3 PM-5 PM **Chapters 16-19**

*Bergstrom & Dugatkin

Laboratory & Field
Tentative Schedule
Spring 2016

Date	Lab
F Jan. 22	No Lab
F Jan. 29	Video: Darwin's Darkest Hour
F Feb. 05	SimBio Lab: Flowers and Trees/ Caminalcules Phylogenetics Laboratory
F Feb. 12	Mammalian Skulls Phylogenetics Laboratory
F Feb. 19	SimBio Lab: Darwinian Snails
F Feb. 26	SimBio Lab: Hardy, Weinberg and Kuru
F Mar. 04	SimBio Lab: Sickle-Cell Alleles
F Mar. 11	No Lab: Spring Break
F Mar. 18	SimBio Lab: HIV Clock
F Mar. 25	No Lab-Easter Break
F Apr. 01	SimBio Lab: How the Guppy Got Its Spots
F Apr. 08	Life on Earth Timeline
F Apr. 15	Comparative Fish Proteomics I
F Apr. 22	Comparative Fish Proteomics II
F Apr. 29	Fossil Collecting Field Trip/ Museum Field Trip