

Evolution
Biology 350 – Spring 2018
College of Charleston, Department of Biology

Lecture: SSMB 138 TuTh 1:40-2:55 PM

Instructor: Dr. Matthew (Matt) Rutter

Office: 152 SSMB

Office Phone: 953-7113

Email: rutterm@cofc.edu (this is the best way to get in touch with me)

Office hours: Wednesday 11am-noon or by appointment. I will be happy to meet with you—just set up a time!

Student Learning Outcomes: 1) to obtain familiarity with the phenomenon of evolution and to understand the mechanisms by which it occurs, 2) to explore the importance of ecological, genetic and developmental context in determining patterns of evolutionary change, 3) to investigate the evolutionary history of life on earth, and 4) to examine the application of evolution to biological problems.

Instructional Objectives:

This semester we will be examining topics including:

- 1) the patterns generated by evolutionary changes
- 2) the processes causing evolutionary changes
- 3) speciation and phylogenetics
- 4) evolutionary ecology and applied evolution
- 5) evolutionary genomics and evolutionary development
- 6) the history of life on Earth

Much of the class is “cumulative” as many of these topics are interrelated!

Prerequisites: Completion of both Biology 211 and 305. Note: **there is math in this class**, so don't be surprised!

Text: Evolution, Making Sense of Life. Zimmer and Emlen. 2nd Edition.

Course Policies

Lecture attendance: A successful student will attend all lectures. I will go BEYOND the text—discussing relevant primary literature and providing additional examples and topics. A prepared student will have read the assigned chapter before coming to lecture.

I welcome questions about the subject matter during lecture. Don't hesitate! I follow the College of Charleston Absence Policy, as described in the student handbook. Did you miss lecture? Get notes and handouts from another student. Exams will come from lecture material in addition to the text.

If you have a planned absence on the day of an exam- you must notify me BEFORE the exam is given. Any make up (with a documented reason) must be completed before I return the graded exams to the rest of the class (no more than 5 days after the exam). All excuses must be documented via the Dean of Undergraduate Study.

Note-taking: Taking notes during an oral presentation, such as a lecture, is an important skill for a student and a scientist. If you miss something in lecture, you are welcome to visit me in my office to discuss and look over slides. I will provide handouts of many critical figures.

Assignments and late policy: For full credit, assignments must be turned in on time. Late assignments will be deducted 5% per school day. Assignments turned in after the assignment is handed back to the rest of the class will not receive credit. Assignments can be turned in directly to me, under my office door at SSMB 152, or in my box in the Biology office on the second floor of SSMB (open 8:30-4pm weekdays).

Computers: Assignments must be typed. There are computer labs for use in SSMB and Addlestone Library.

Courtesy: During class, please turn off (or put in silent mode) cell phones and other devices that make sound. **Please do not talk on the phone, text, IM, browse the web, email, facebook, etc. during discussion or lecture.** If you must leave early or arrive late, please sit in back.

Academic honesty: Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when identified, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student's actions are related more to a misunderstanding will be handled by the instructor. A written intervention designed to help prevent the student from repeating the error will be given to the student. The intervention, submitted by form and signed both by the instructor and the student, will be forwarded to the Dean of Students and placed in the student's file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This grade will appear on the student's transcript for two years after which the student may petition for the XX to be expunged. The F is permanent.

Students should be aware that unauthorized collaboration--working together without permission-- is a form of cheating. Unless the instructor specifies that students can work together on an assignment, quiz and/or test, no collaboration during the completion of the assignment is permitted. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information via a cell phone or computer), copying from others' exams, fabricating data, and giving unauthorized assistance. Research conducted and/or papers written for other classes cannot be used in whole or in part for any assignment in this class without obtaining prior permission from the instructor. Students can find the complete Honor Code and all related processes in the Student Handbook at <http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

If you have questions on how to properly cite, paraphrase or document literature sources, it is your responsibility to consult me for assistance. **PLAGIARISM, INCLUDING FROM WIKIPEDIA, WILL RESULT IN A ZERO ON THE ASSIGNMENT, POSSIBLE FAILURE IN THE COURSE AND HONOR BOARD REFERRAL.**

Center for Student Learning: I encourage you to utilize the Center for Student Learning's (CSL) academic support services for assistance in study strategies, speaking & writing strategies, and course content. They offer tutoring, Supplemental Instruction, study strategy appointments, and workshops. Students of all abilities have become more successful using these programs throughout their academic career and the services are available to you at no additional cost. For more information regarding these services please visit the CSL website at <http://csl.cofc.edu> or call (843)953-5635.

Disability Access: The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before the accommodation is needed.

Lecture Schedule (may change as necessary)

Jan 9 (Tu) – **Introductions** – Nothing Makes Sense, Except...– What is Biology 350 All About? – Introductions -- Pestilence as a Useful Illustration
Readings: Ch 1

Jan 11 (Th) – **HIV** - HIV basics – Death, disease, and HIV – Why does HIV become resistant? – Why does HIV kill? – Susceptibilities
Readings: Ch 1

Jan 16 (Tu) **The Origin of an idea** –Darwin, Not in a Vacuum -- Darwin, Darwin and Wallace – The two big ideas -- Evidence at Many Scales
Readings: Ch 2

Last day of Drop/Add

Jan 18 (Th) – **Introduction to Natural Selection** – Check your intuition – The Three (or 4) Necessities – Sure you vary, but do you inherit? – What does it take to be fit? – Experimental Detection (Is A Lot of Work) -- Finches, Finches, Finches, Darwin, Grant and Grant
Readings: Chapters 1 and 8

Jan 23 (Tu) –**Selection and Phylogeny Introduction** – Selection can't do everything – Tree thinking – Phylogeny 101 -- How To Read a Tree
Readings: Ch 4 and 8

Jan 25 (Th) **Phylogeny and Simple Genetics** – Phylogenies and inference – Genes and alleles – What does genetic variation look like?
Readings: Chapters 4 and 5

Jan 30 (Tu) **Mutations and Hardy-Weinberg** – Where all alleles are from -- A Bestiary of Mutants – Mutation Accumulation -- Duplications – Mutation rates and traits -- Focus on the Population -- What Happens When Nothing is Happening – Assumptions and Violations -- Deviating from Hardy-Weinberg
Readings: Chapters 5 and 6

Feb 1 (Th) **Evolutionary Processes**— The Four Horsemen of Evolution: Selection, Mutation, Migration and Drift -- A Mathematical Outcome – Selection and Hardy-Weinberg -- Selection and Mutation Changing Phenotypes -- Mutation and Hardy-Weinberg – Mutants and Consequences
Readings: Chapter 6

Feb 6 (Tu) **Return to Selection** - Artificial Selection, The Civilized World Thanks You – What Darwin Noticed -- Pleiotropy and Correlations –What's the Frequency?
Readings: Ch 6 and 8

Feb 8 (Th) **EXAM I**

Feb 13 (Tu) **Sexual Selection and Nonrandom mating** – Boys and Girls, Looking Different – Competing Males – Choosy Females – Runaway! Heterosis, Dominance, and Other Wrinkles What Nonrandom Mating Can Do – Inbred and Depressed About It – Plants are Weird
Readings: Chapters 6 and 11

Feb 15 (Th) **Gene Flow and Genetic Drift** --- Migration Makes Everything the Same – Migration Vs. Selection -- What is Random? Drifting beans -- The Smaller, The Driftier
Readings: Chapter 6

Feb 20 (Tu) **Genetic Drift and Neutral Theory** -- What Happened to the Heterozygotes – Effective Populations – Neutral Theory – Neutrality in the Molecular Genetic Age The Model Doesn't Fit – Ohta's Insight
Readings: Chapters 6, 9

Feb 22 (Th) **The Evolution of Quantitative Characters** – Characters can be complex – Linkage Disequilibrium – The Landscape of Adaptation
Breaking down the Variance – Meet QTLs -- The Breeder's Equation – Fisher's Fundamental Theorem -- Directional, Stabilized and Disrupted
Readings: Ch 7

Feb 27 (Tu) **Genome Evolution** – Surprises from sequencing – Is bigger better? – The smallest: viruses – The mid-size: prokaryotes – How do the eukaryotes do it? – Selection from a sequence?
Readings: Ch 9

Mar 1 (Th) **Species and Speciation** – Everyone Knows the BSC. Nobody Likes the BSC. – New Ideas – Allopatry and Vicariance – Sympatry – Drifting Apart – Selected to Differ – Mutants Apart – Hybrids
Readings: Ch 13

Mar 6 (Tu) **Speciation** – More on Hybrids – Sticklebacks and Cichlids – Aphids – Other Examples
Readings: Ch 13

Mar 8 (Th) **The Evolution of Sex** – Linked To Sex – Deducing Evolution and History From Linkage -- Sex Has Its Costs – Recombining -- Muller's Ratchet – The Environment Changes
Readings: Ch 11

Mar 13 (Tu) **Coevolution: Competition, Predation and Herbivory**– The End of Competition – Ecological Release -- Kill Your Prey, If You Can Catch Them -- The Joys of Tasting Bad – Arms Races -- Should you specialize? – Manifold defenses – Congruent Phylogenies
Readings: Chapter 8, 10, 15

Last day to withdraw from classes

Mar 15 (Th) **EXAM II**

March 17-25 **SPRING BREAK**

Mar 27 (Tu) **Parasitism and Mutualism**– Genes for Genes – Avoid the Virulent More than 2 species— When It's Good to Be Good – A Prisoner's Dilemma --
Readings: Ch 15

Mar 29 (Th) **Altruism, Eusociality and the Evolution of Behavior** –Close Relatives – Social vs. Sociality -- Oh, Behave
Readings: Chapter 16

Apr 3 (Th) **Senescence and the Evolution of Development** –We Get Old and Die. Why? – Life Histories – Live Fast, Die Young? – Bad Mutants – Tradeoffs, Tradeoffs – Costs of Reproduction – Evolution Shapes Development and Vice Versa – Homeotic Genes and Deep Plans – Of Eyes and Limbs – Flowers
Readings: Chapters 10 and 12

Apr 5 (Th) **Human Disease and Applied Evolution** –Flu – Birds and Pigs And Man –HIV – Antibiotic Resistance – Cancer – Sickle Cell – Fever – Mad Cow and Weird Things -- Discouraging Resistance – Tracking Disease and Criminals – Directed Evolution
Readings: Ch 18

Apr 10 (Tu) **Origins of Life** – What We Don't Know – RNA World – My Name Is LUCA – Experiments and Inferences About Early Earth – What Does The Phylogeny Say?
Readings: Ch 3

Apr 12 (Th) **Precambrian Evolution, the Cambrian Explosion and the Invasion of Land** – Single Cells – The Oxygen Revolution – Endosymbiosis – Early Animals And Plants – Burgess Shale – Punctuated Equilibrium-- Gondwana
Readings: Chapters 3 and 14

Apr 17 (Tu) **The Invasion of Land and the Dinosaurs** -- Ordovician, Silurian, Devonian – Plants and Animals Storm Out of the Water – The Carbon Swamps and the Permian Extinction Drifting Continents – Gymnosperms, Deserts and Dinosaurs – Triassic, Jurassic, Cretaceous
Readings: Chapters 3 and 14

Apr 19 (Th) **After the Dinosaurs** – The Upstarts: Mammals, Birds and Flowers -- Horses – Primates, Monkeys, Apes and Humans – Ice Ages – Behavior and Culture
Readings: Ch 3, 14 and 17

Apr 24 (Tu) **Reading Day**

May 1 (Tu) FINAL EXAM 12-3pm SSMB 138

COURSE REQUIREMENTS AND GRADE CALCULATION

- Two in class exams: 300 Pts.
- Final exam (final part of course plus cumulative material): 200 Pts.
- Darwin Week Report (details later) 30 Pts.
- Evolutionary literature 1 (Origin of Species) 30 Pts.
- Evolutionary literature 2 30 Pts.
- Evolutionary literature 3 30 Pts.
- Evolutionary literature 4 30 Pts.
- **Total Points:** 650

Grades: A: 92.5% and up

A-: 89.5% - 92.4%

B+: 86.5% - 89.4%

B: 82.5% - 86.4%

B-: 79.5% - 82.4%

C+: 76.5% - 79.4%

C: 72.5% - 76.4%

C-: 69.5% - 72.4%

D+: 66.5% - 69.4%

D: 62.5% - 66.4%

D-: 59.5% - 62.4%

F: 59.4% and below

Other aspects of grading follow C of C standards.

Last day to drop with grade of "W" is March 13