

Evolution
Biology 350 – Spring 2020
College of Charleston, Department of Biology

Lecture: RITA 103 MW 2:00-3:15 PM

Instructor: Dr. Matthew (Matt) Rutter

Office: RITA 231

Office Phone: 843-953-7113

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

Office hours: **Wednesday 1pm-2pm 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: Evolutionary Analysis, 5th 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 RITA 231, or in my box in the Biology office on the second floor of RITA (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.

Honor Code and Academic Integrity:

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 misunderstanding and confusion will be handled by the instructor. The instructor designs an intervention or assigns a grade reduction to help prevent the student from repeating the error. The response is recorded on a form and signed both by the instructor and the student. It is forwarded to the Office of 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 status indicator 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 can find the complete Honor Code and all related processes in the *Student Handbook* at <http://deanofstudents.cofc.edu/honor-system/studenthandbook/index.php>

Disability/Access Statements (choose 1):

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 accommodation is needed.

Center for Student Learning:

The Center for Student Learning's (CSL) academic support services provide assistance in study strategies, speaking & writing skills, and course content. Services include tutoring, Supplemental Instruction, study skills 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.

Mental & Physical Wellbeing:

At the college, we take every students' mental and physical wellbeing seriously. If you find yourself experiencing physical illnesses, please reach out to student health services (843.953.5520). And if you find yourself experiencing any mental health challenges (for example, anxiety, depression, stressful life events, sleep deprivation, and/or loneliness/homesickness) please consider contacting either the Counseling Center (professional counselors at <http://counseling.cofc.edu> or 843.953.5640 3rd Robert Scott Small Building) or the Students 4 Support (certified volunteers through texting "4support" to 839863, visit <http://counseling.cofc.edu/cct/index.php>, or meet with them in person 3rd Floor Stern Center). These services are there for you to help you cope with difficulties you may be experiencing and to maintain optimal physical and mental health.

Food & Housing Resources:

Many CofC students report experiencing food and housing insecurity. If you are facing challenges in securing food (such as not being able to afford groceries or get sufficient food to eat every day) and housing (such as lacking a safe and stable place to live), please contact the Dean of Students for support (<http://studentaffairs.cofc.edu/about/salt.php>). Also, you can go to <http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php> to learn about food and housing assistance that is available to you. In addition, there are several resources on and off campus to help. You can visit the Cougar Pantry in the Stern Center (2nd floor), a student-run food pantry that provides dry-goods and hygiene products at no charge to any student in need. Please also consider reaching out to Professor ABC if you are comfortable in doing so.

Inclusion:

The College of Charleston offers many resources for LGBTQ+ students, faculty and staff along with their allies.

[Preferred Name and Pronoun Information](#)

[On Campus Gender Inclusive facilities](#)

[Campus Resources](#)

[College of Charleston Reporting Portals](#)

[National Resources for Faculty & Staff](#)

[GSEC Reports](#)

[Documenting LGBTQ Life in the Lowcountry](#) (CofC Addlestone Library

Special Collections Project)

[College of Charleston Quality Enhancement Plan \(QEP\)](#)

[Articles about CofC and LGBTQ+ Issues](#)

Inclement Weather:

If the College of Charleston closes and members of the community are evacuated due to inclement weather, students are responsible for taking course materials with them in order to continue with course assignments consistent with instructions provided by faculty. In cases of extended periods of institution-wide closure where students have relocated, instructors may articulate a plan that allows for supplemental academic engagement despite these circumstances.

Statement on “Religious Accommodation for Students”

[\(Faculty/Administration Manual VIII.A.10\)](#)

The College of Charleston community is enriched by students of many faiths that have various religious observances, practices, and beliefs. We value student rights and freedoms, including the right of each student to adhere to individual systems of religion. The College prohibits discrimination against any student because of such student’s religious belief or any absence thereof.

The College acknowledges that religious practices differ from tradition to tradition and that the demands of religious observances in some traditions may cause conflicts with student schedules. In affirming this diversity, like many other colleges and universities, the College supports the concept of “reasonable accommodation for religious observance” in regard to class attendance, and the scheduling of examinations and other academic work requirements, unless the accommodation would create an undue hardship on the College. Faculty are required, as part of their responsibility to students and the College, to ascribe to this policy and to ensure its fair and full implementation.

The accommodation request imposes responsibilities and obligations on both the individual requesting the accommodation and the College. Faculty members are expected to reasonably accommodate individual religious practices. Examples of reasonable accommodations for student absences

might include: rescheduling of an exam or giving a make-up exam for the student in question; altering the time of a student's presentation; allowing extra-credit assignments to substitute for missed class work or arranging for an increased flexibility in assignment dates. Regardless of any accommodation that may be granted, students are responsible for satisfying all academic objectives, requirements and prerequisites as defined by the instructor and by the College.

Lecture Schedule (may change as necessary)

Jan 8 (W) – **Introductions** – Nothing Makes Sense, Except...– What is Biology 350 All About? – Introductions -- Pestilence as a Useful Illustration
Readings: Ch 1

Jan 13 (M) – **HIV** - HIV basics – Death, disease, and HIV – Why does HIV become resistant? – Why does HIV kill? – Susceptibilities
Readings: Ch 1

Jan 15 (W) **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 FOR ADD/DROP

Jan 20 (M) MLK day, no lecture

Jan 22 (W) – **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: Ch 3

Jan 27 (M) –**Selection and Phylogeny Introduction** – Selection can't do everything – Tree thinking – Phylogeny 101 -- How To Read a Tree – Homology and Homoplasy
Readings: Chapters 3, 4

Jan 29 (W) **Phylogeny and Simple Genetics** – Phylogenies and inference – Genes and alleles – What does genetic variation look like?
Readings: Chapters 4, 5

Feb 3 (M) **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: Ch 5, 6

Feb 5 (W) **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: Ch 7

Feb 10 (M) **Return to Selection** - Artificial Selection, The Civilized World Thanks You – What Darwin Noticed -- Pleiotropy and Correlations –What’s the Frequency?
Readings: Ch 6, 7

Feb 12 (W) **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: 11

Feb 17 (M) **EXAM I**

Feb 19 (W) **Gene Flow and Genetic Drift** --- Migration Makes Everything the Same – Migration Vs. Selection -- What is Random? Drifting beans -- The Smaller, The Driftier
Readings: Ch 7

Feb 24 (M) **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: Ch 7

Feb 26 (W) **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 9

Mar 2 (M) **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 15

Mar 4 (W) **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 16

Mar 9 (M) **Speciation** – More on Hybrids – Sticklebacks and Cichlids – Aphids – Other Examples
Readings: Ch 16

Mar 11 (W) **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 8

Mar 13 (F) Last day to withdraw with a grade of W

March 14-22 **SPRING BREAK**

Mar 23 (M) **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: None

Mar 25 (W) **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 14

Mar 30 (M) **EXAM II**

Apr 1 (W) **Altruism, Eusociality and the Evolution of Behavior** –Close Relatives – Social vs. Sociality -- Oh, Behave
Readings: Chapter 12

Apr 6 (M) **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: Ch 13, 19

Apr 8 (W)**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 14

Apr 13 (M) **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 17

Apr 15 (W) **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: Ch 17, 18

Apr 20 (M) **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: Ch 18

Apr 22 (W) **After the Dinosaurs** – The Upstarts: Mammals, Birds and Flowers -- Horses – Primates, Monkeys, Apes and Humans – Ice Ages –Culture
Readings: Ch 18, 20

Apr 23 (Th) **Reading Day**

Apr 29 (W) FINAL EXAM 8-11am RITA 103

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 Other aspects of grading follow C of C standards.

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