Evolution
Biology 350 – Spring 2023
College of Charleston, Department of Biology

Lecture: RITA 103 TuTh 10:50 AM – 12:05 PM

Instructor: Dr. Matthew (Matt) Rutter
Office: RITA 205
Email: rutterm@cofc.edu (this is the best way to get in touch with me)
Office hours: Wednesday 9 am – 10 am 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!


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 with some possible examples drawn from 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).

Only students officially registered (graded or auditing) for this course may attend class. During the week following the drop/add deadline, the professor will verify student enrollments in this course. Any student appearing on the class roll but determined not to have attended the class even once will be removed, except for cases where a student is absent because of quarantine or isolation due to COVID-19.

COVID-19 Pandemic Flexible Instruction Policy: If one or more students are absent for an extended period of time due to COVID-19 (quarantine or isolation), I may, at my discretion, conduct the class exclusively online via OAKS for the duration of student quarantine/isolation, record class lessons to share with students, or choose an alternate accommodation that provides the impacted student(s) with the opportunity to continue in the course. The specific accommodation will vary depending on the number of students affected, the expected duration of their absence, and the needs of the class.

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 205, 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, use social media, etc. during lecture. If you must leave early or arrive late, please sit in back.

Academic Integrity Statement:
As members of the College of Charleston community, we affirm, embrace and hold ourselves accountable to the core values of integrity, academic excellence, liberal arts education, respect for the individual student, diversity, equity and inclusion, student centeredness, innovation and public mission. Congruent with
these core values, the College of Charleston expects that every student and community member has a responsibility to uphold the standards of the honor code, as outlined in the Student Handbook. In pursuit of academic learning, you are expected to reference the work of other scholars, and complete your own academic work, while utilizing appropriate resources for assistance. Any acts of suspected academic dishonesty will be reported to the Office of the Dean of Students and addressed through the conduct process. Your adherence to these practices and expectations plays a vital role in fostering a campus culture that balances trust and the pursuit of knowledge while producing a strong foundation of academic excellence at the College of Charleston. Any questions regarding these expectations can be clarified by your instructor.

Accommodations for Students with Disabilities:
The Center for Disability Services/SNAP is committed to assisting qualified students with disabilities achieve their academic goals by providing reasonable academic accommodations under appropriate circumstances. If you have a disability and anticipate the need for an accommodation in order to participate in this class, please connect with the Center for Disability Services/SNAP. They will assist you in getting the resources you may need to participate fully in this class. You can contact the Center for Disability Services/SNAP office at 843.953.1431 or at snap@cofc.edu. You can find additional information and request academic accommodations at the Center for Disability Services/SNAP website.

OAKS
OAKS, including Gradebook, will be used for this course throughout the semester to provide the syllabus and class materials and grades for each assignment, which will be regularly posted.

Inclement Weather, Pandemic or Substantial Interruption of Instruction
If in-person classes are suspended, faculty will announce to their students a detailed plan for a change in modality to ensure the continuity of learning. All students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools.
When students are quarantined/isolated due to Covid-19

If one or more students are absent for an extended period of time due to COVID-19 (quarantine or isolation), instructors may, at their discretion, conduct the class exclusively online via OAKS for the duration of student quarantine/isolation, record class lessons to share with students, or choose an alternate accommodation that provides the impacted student(s) with the opportunity to continue in the course. The specific accommodation will vary depending on the number of students affected, the expected duration of their absence, and the needs of the class.

Attendance Verification

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Land and Labor Acknowledgement

We are located on the traditional lands of the first people of Charleston: the Etiwan, Kiawah, Edisto Natchez Kusso, Santee, and Wassamassaw people (also known as Varner Town Indians). We acknowledge and honor all indigenous people who lived, labored and were faithful stewards of the land. We express our deep gratitude for the land and continued faithful stewardship to the next generations.

We also acknowledge the lives and labor of the Africans who were enslaved to build Charleston, South Carolina. On this campus and in this space, African and African-descended people used skilled labor in ornamental ironwork, historic architecture, and low country agriculture and food production. As a member of the College of Charleston community, I acknowledge the Black lives and labor that built our city and our campus.

Diversity and Inclusion in the classroom

I am committed to creating an inclusive and accessible classroom environment for all students. I view the diversity that students bring to this class as a resource, strength, and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, generational status, socioeconomic status, ethnicity, race, religious background, and immigration
status. Any suggestions for promoting a positive and open environment will be appreciated and given serious consideration.

I will gladly honor your request to address you by the name and gender pronouns of your choice. Please advise me of this early in the semester via your college-issued email account or during office hours so that I may make the appropriate notation on my class list.

Inclusion

The Multicultural Student Programs and Services provides a safe haven for students to develop connections with other students. It exists to help students be successful, provide advocacy, support services, and culturally based programs that educate about diversity and multiculturalism and empower them to be agents of social change in an increasingly diverse and global community.

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

In keeping with the College of Charleston’s core values of diversity, equity and inclusion, the Cougar Inclusion Team (CIT) provides education, information, and recommendations regarding support resources to members of the campus community who have experienced exclusion or bias. The CIT works to support members of our campus community who report concerns by listening, discussing resources, providing guidance on resolution options, conducting education, and collecting information about occurrences on our campus. A report to the CIT team helps us better understand our campus climate, informs our educational and infrastructure opportunities to address concerns that are shared, and fosters an environment where everyone feels welcome.
Mental & Physical Wellbeing
We take every student’s 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 CofC Counseling Center or 843.953.5640 3rd Floor of Robert Scott Small Building) or the Students 4 Support (certified volunteers through texting "4support" to 839863, or meet with them in person 411 (4th Floor) Stern Center). Learn more about Students 4 Support on CofC’s Hub. 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 (SALT - Student Affairs Leadership Team). Also, you can go to Student Food and Housing Insecurity 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.

Religious Accommodation for Students:
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.

### 2022 – 2023 Religious Holidays

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<thead>
<tr>
<th>Date</th>
<th>Holiday</th>
<th>Religion</th>
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<tbody>
<tr>
<td>September 26 – October 4, 2022</td>
<td>Navaratri</td>
<td>Hindu</td>
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<tr>
<td>September 26 – September 27, 2022</td>
<td>Rosh Hashanah&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<tr>
<td>October 4 – October 5, 2022</td>
<td>Yom Kippur&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<td>October 10 – October 16, 2022</td>
<td>Sukkot&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<td>October 17 – October 18, 2022</td>
<td>Shemini Atzeret&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<tr>
<td>October 24, 2022</td>
<td>Diwali</td>
<td>Hindu</td>
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<tr>
<td>February 22, 2023</td>
<td>Ash Wednesday (Beginning of Lent)</td>
<td>Christian</td>
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<td>February 27, 2023</td>
<td>Eastern Orthodox Beginning of Lent</td>
<td>Orthodox Christian</td>
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<tr>
<td>March 7, 2023</td>
<td>Purim&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<td>March 21, 2023</td>
<td>Naw-Rúz</td>
<td>Baha’i</td>
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<tr>
<td>March 23 – April 20, 2023</td>
<td>Ramadan</td>
<td>Muslim</td>
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<td>April 6 – April 13, 2023</td>
<td>Passover&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Jewish</td>
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<td>April 7, 2023</td>
<td>Good Friday</td>
<td>Christian</td>
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<tr>
<td>April 14, 2023</td>
<td>Good Friday (Orthodox)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>Orthodox Christian</td>
</tr>
<tr>
<td>April 21, 2023</td>
<td>Ridván</td>
<td>Baha’i</td>
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<tr>
<td>April 21 – April 22, 2023</td>
<td>Eid al-Fitr</td>
<td>Muslim</td>
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<sup>1</sup> The previously included Islamic holiday of Eid al-Adha falls outside the regular academic year and is therefore not listed here. Other religious holidays such as Hanukkah (12/19–12/26), Orthodox Christian Christmas (1/7), Sankranti (1/14) and Purim (3/7) fall outside of the semester class schedule (breaks and weekends) and therefore are also not listed.

<sup>2</sup> Orthodox Christian holidays begin at sunset on the evening before the date given.

<sup>3</sup> Orthodox Christian holidays begin at sunset on the evening before the date given.
Lecture Schedule (may change as necessary)

Jan 12 (Th) – **Introductions** – Nothing Makes Sense, Except…– What is Biology 350 All About? – Introductions -- Pestilence as a Useful Illustration
Readings: Ch 1

Readings: Ch 1

Jan 18 (W) **LAST DAY FOR ADD/DROP**

Jan 19 (Th) **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

Jan 24 (Tu) – **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 10.1

Jan 26 (Th) – **Selection and Phylogeny Introduction** – Selection can’t do everything – Tree thinking – Phylogeny 101 -- How To Read a Tree – Homology and Homoplasy
Readings: Chapters 2, 4.1, 4.2

Jan 31 (Tu) **Phylogeny and Simple Genetics** – Phylogenies and inference – Genes and alleles – What does genetic variation look like?
Readings: Chapters 4.3- 4.7, 5.1, 5.2

Feb 2 (Th) **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, 6.1-6.3

Feb 7 (Tu) **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 6-7
Readings: Chs 6, 10

Feb 14 (Tu) **EXAM I**

Feb 16 (Th) **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: Ch 11

Feb 21 (Tu) **Gene Flow and Genetic Drift** — Migration Makes Everything the Same – Migration Vs. Selection -- What is Random? Drifting beans -- The Smaller, The Driftier
Readings: Ch 6

Feb 23 (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 8.6

Feb 28 (Tu) **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 Theorum -- Directional, Stabilized and Disrupted
Readings: Ch 7

Readings: Ch 5.3, 8

Mar 5 – Mar 12 **SPRING BREAK**

Mar 14 (Tu) **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 16 (Th) **Speciation** – More on Hybrids – Sticklebacks and Cichlids – Aphids – Other Examples
Readings: Ch 13
Mar 21 (Tu) **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 23 (Th) **EXAM II**

Mar 24 (F) Last day to withdraw with a grade of W

Readings: 15.1-15.3

Mar 30 (Th) **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

Apr 4 (Tu) **Altruism, Eusociality and the Evolution of Behavior** – Close Relatives – Social vs. Sociality – Oh, Behave
Readings: Chapter 16

Readings: Ch 12

Readings: Ch 18

Readings: Ch 3, 4, 8

Apr 18 (Tu) **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 3, 4, 8, 14
Apr 20 (Th) **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 3, 4, 8, 14

Apr 25 (Tu) **After the Dinosaurs** – The Upstarts: Mammals, Birds and Flowers -- Horses – Primates, Monkeys, Apes and Humans – Ice Ages –Culture
Readings: Ch 3, 17

Apr 27 (Th) **Reading Day**

Apr 29 (Sat) **FINAL EXAM 1-3 pm RITA 103**

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**COURSE REQUIREMENTS AND GRADE CALCULATION**

- Two in class exams: 250 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**: 600

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.