Instructional Objectives

This course is intended to foster an understanding of the diverse ways organisms interact with the environment, the fundamental principles of ecology, evolution, and conservation biology, and to learn about the three domains of biodiversity on Earth. More specifically as a student in this course you will

- review the theory of evolution, as posed by Charles Darwin.
- explore the modern synthetic view of evolution which integrates genetics, molecular biology and many other areas of biology into an explanation of how evolution occurs.
- explore mechanisms (or processes) of evolution including
  - how populations evolve at the genetic level (evolutionary genetics).
  - how new species arise (speciation).
  - how biologists are revealing the way life diversified on earth and what the current “tree of life” looks like (systematics & phylogeny).
- explore the evidence in support of evolutionary theory and processes.
- explore the features of the diverse species that inhabit the planet to discover
  - the anatomical, physiological and behavioral associations between related groups of organisms.
  - the contributions of the diverse groups of living organisms to ecological systems and human welfare.
  - an astonishing variety of lifestyles, traits, and solutions to the challenges of life.
- explore how populations change in abundance and distribution (population ecology).
- explore ecological interactions between species (community ecology).
- explore processes and changes that occur at the level of ecosystems.
- apply evolutionary and ecological concepts and theories to issues related to the conservation of biodiversity on earth (conservation biology).
Student Learning Outcomes

At the end of this course, students are expected to be able to:

- describe the processes by which populations of organisms change in size
- explain the forces that lead to evolutionary change in populations and diversification among species
- interpret phylogenetic trees to comprehend the evolutionary relationships they depict
- discuss how interactions with the physical environment and with other organisms influence populations and communities
- build a foundation of knowledge about life’s diversity and its interrelatedness
- apply ecological and evolutionary principles to the conservation of biodiversity
- apply the following skills used by professional biologists: use primary literature, generate scientific questions and pose testable hypotheses, analyze data to evaluate hypotheses, use quantitative models to describe biological processes, and communicate these to a scientific audience.

We will work throughout the semester toward achieving these objectives and outcomes, including through participation in a CURE (Course Based Research Experience)—where you will act as a scientist by participating in biological discovery to be shared with students and researchers globally.

The first two thirds of the course are conceptual and quantitative. Many of these topics you may have encountered briefly in 111 or 112. We will take these ecological and evolutionary principles to the next level engaging quantitative and modelling aspects to inquiry. I emphasize reading and writing graphs to develop conceptual and quantitative components of evolutionary and ecological topics and how they relate to conservation biology. We will investigate mathematical and conceptual models, write models, work with data, use models to make predictions and use evidence to make biological arguments. I will provide problem sets, worked problems in class and quizzes as ways to develop these skills.

In the third section of the course, I will introduce you to the diversity of life on the planet. As conservation of biodiversity includes phylogenetic understanding we emphasize reading, building, and creating phylogenies. To be able to bring these concepts to upper division comparative courses, this component of the course also requires a concerted effort in developing skills for learning a large body of material and synthesizing this material in a united framework. These skills and understanding of relationships among organisms are essential for future biology major courses as well as careers across the spectrum of biology from conservation to medicine.

**Discussion sessions:** The discussion sections are a critical component of this course. We will build many of the tools of how scientists do science during discussion. We will spend time working on data analysis, presentation, and scientific writing. Students will work both independently and in groups (as scientists do in their daily lives). In the discussion sections, we will investigate several research projects. We will examine the primarily literature extensively and investigate published data.
**Prerequisites** for this course include Biology 111, Biology 111L, Biology 112 and Biology 112L. Successful completion of these courses is required for enrollment in 211. Suggested Math knowledge: through algebra or pre-calculus.

**Texts:** We will not have a required text for my Biology 211 course. All required material will be presented in lecture. HOWEVER, many of the examples and ideas are connected to the “Biological Science” textbook authored by Freeman. A copy of any of 4th, 5th, 6th or 7th edition will be helpful to review the material—I will be happy to let you know what chapters correspond to the topics we are discussing.

**Course Policies**

**Lecture attendance:** Attendance in lecture will set you on the road to success in this course. During lecture, I will describe evolutionary, ecological and conservation principles and share examples from the recent literature. Coming prepared to lecture, by having read the assigned chapter will be an asset towards understanding the topics covered. Lecture is an excellent time to ask questions and participate in an active discussion of topics. Miss lecture? Get notes and handouts from another student (note, exam questions come from lecture as well as the text). If you will have a planned absence on the day of an exam – you must notify me BEFORE the exam is given if possible. I may request documentation associated with absences for missed exams. Any make up (with a documented reason) must be completed before the exam is returned to the class (1-5 days from scheduled exam time).

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.

**Note-taking:** I consider note taking an important skill to develop as a student. I will provide very general outlines accompanied by graphics that are not available in your textbook.

Stay tuned for information about on-line availability of hand outs, study guides, etc. I plan to use OAKS this semester extensively and there may be adaptation to COVID-19 related conditions.

**Discussion attendance:** Attendance to discussion sections is a required component of this course and is mandatory. For group projects, other students will be counting on your presence, effort and intellectual engagement in the project. Participation in both independent and group aspects will contribute to your grade. Students who in the past have not come to discussion and have not handed in assignments end up doing very poorly in the overall course — as the writing assignments in discussion are a large component of the overall course grade. You lose much more than the participation points associated with that week. If you miss a discussion section, it is the student’s responsibility to contact the professor — work must be made up. If even one discussion project is not completed, it is likely that you will fail the course.

**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.

**Assignments and late policy:** Assignments will be turned in on time to be considered for full credit. A loss of 5% will be deducted per school day for any late assignment. Zero points will be recorded for an assignment if it is not turned in before the assignment is passed back, discussed in class or key posted. Suitable means to turn in assignment – directly to me, under the office door of RITA 205, or in mailboxes in the Biology office in RITA 230 (office hours are 8:30-4pm weekdays, check in at the Biology main office RITA 245 if you can’t get to the mailboxes).

**Computers:** All assignments will be required to be completed on a word processor (or other necessary software (e.g., Excel, PowerPoint, etc.). There are computer labs in the Addlestone library, RITA, SSMB and other locations around campus.

**Class Courtesies:** Be on time, put cell phones and other devices that beep in silent mode (do not talk on the phone or text message, use social media apps, or conduct web searches not associated with assignments during discussion or lecture), do not eat, drink or smoke in the laboratory, do study, do ask questions, if you must leave early or arrive late please sit in the back (and let me know before class starts), be courteous to your colleagues. **Bring your enthusiasm – it is contagious.**

**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 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](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](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.

**Inclement weather plan:** 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 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.

**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](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](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](http://studentaffairs.cofc.edu/about/salt.php)). Also, you can go to [http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php](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 me if you are comfortable in doing so.
Lecture Schedule

Aug 24 (W) – **Introductions** – What is Biology 211 all about? – The Age of Biology – Genomic Discoveries and Ecological Destruction -- The Diversity of Life and Its Uncertain Future


**Monday Aug 29 Last day of Drop/Add**

Aug 31 (W) – **Evolution and Natural Selection** – An Ancestor In Common -- Fruit Flies and Extra Eyes -- The Four Essential Ingredients – Did You Inherit Your Height? – Fitness and Adaptation

Sep 5 (M) – **Selection and Population Genetics** – Catching Selection in the Act --Nothing Makes Sense (Except) -- Myths and Misperceptions -- Four Modes – What Happens When Nothing’s Happening

Sep 7 (W) – **Evolutionary Process** –Direct, Stabilized & Disruptive -- Sex Changes Everything -- Drifting at Random – Immigration: Genes Go With the Flow – Mutants!

Sep 12 (M) **Evolution to Ecology**– Sex with Relatives and Why Some Avoid It –Just One Word: “Plasticity” -- Abundant and Distributed – Between Birth and Death: Fecundity – Table of Life and Curve of Survival – Life's Histories -- Yes, You Need Math – When Growth is Exponential


**Sep 26 (M) – EXAM I**

Sep 28 (W) – **Parasitism, Mutualism and Communities** — Lots of Dead Rabbits -- Can We All Just Get Along? – Are Mutualists Just Happy Parasites? – It Takes A Community -- Keystones: Pillars of the Community – Island Intrigue

Oct 3 (M) **Community Structure** -- Clements, Gleason, and Finding Succession – Disturbed – Putting Numbers on Diversity – How to be Stable and Productive – The Puzzle of Tropical Diversity

Oct 10 (M) Biogeochemistry, Climate and Biogeography – Where Does All the Energy Go? -- Wheel of Nutrients The H2O, C and N Go Round and Round -- Why Things are Where They Are -- From the Winter to the Summer, From the Mountains to the Sea


Oct 17 (M) Phylogenetics and the History of Life – Building Trees From Bones and Genes Traits and Trees -- Radiation -- The Ticking Molecular Clock -- Life on Earth in 50 minutes -- The Cambrian Explosion -- Duplication and Diversification -- Mass Extinction -- Roots of the Tree

Oct 19 (W) The Domains of Life and Introduction to Bacteria — The Little Creatures that Run the World -- Bacteria – Archaea -- Disease and Environmental Catastrophe How to Grow Germs (and other Microbes) -- Detecting the Undetectable

Oct 24 (M) Bacteria and Archaea -- So Many Lifestyles -- Marching through Bacteria -- Evolution and Drug Resistance -- Meet the Archaea

Oct 26 (W) EXAM II

Oct 28 (F) Last day to withdraw with a grade of “W”

Oct 31 (M) Eukaryotes and Protists – Major, Major Transitions in Evolution — Protists are Paraphyletic -- Microscopic But a BIG DEAL -- Clues to the Big Tree -- Cells Inside Cells -- Nifty Features -- Cells Upon Cells -- How To Get Around -- Protist March

Nov 2 (W) Protists and Plants — Apicomplexans, Parabasalids and Other Oddities – All Algae Are Not Alike -- How Green Are Your Algae?

Nov 7 (M) NO CLASS – FALL BREAK

Nov 9 (W) Plants -- Plants ARE More Exciting Than You Think -- Mosses -- Ferns -- Alternation of Generations -- Plant Sex Isn’t For the Faint of Heart -- Pollen, then Seeds, then Flowers -- Cycads and Ginkgoes -- Cones on Parade

Nov 14 (M) Gymnosperms & Angiosperms — PlantLand -- Flowers -- The Beautiful Revolution -- Ovaries -- Exquisite Mutualisms and Other Manipulations -- Monocots, Yes, But Dicots?

Nov 16 (W) Fungi and Animal Introduction – Absorb the Dead, Absorb the Living -- Sex and Asex Among the Fungi -- Mutualists and Parasites -- The Faces of the Fungus -- Dead Frogs -- What is an Animal?


Nov 23 (W) THANKSGIVING BREAK – NO CLASS
Nov 28 (M) **Animals: Diploblasts, Acoelomorphs and Protostomes** — Cnidaria — Ctenophera — Acoelomorpha — Racing Rotifers — Platyhelminthes are Flat — Segments Bring Power To Annelids — Mollusca: From Edible to Smart

Nov 30 (W) **Protostomes and Deuterostomes** — Nematodes in Numbers — Arthropods Rule — Chelicerates — Insecta Dominates — Crustaceans In and Above Water — Your Closest Relatives, Phylogenetically Speaking — Spiny Echinoderms — Radial Symmetry Revisited

Dec 5 (M) **Deuterostomes** — Know Your Chordates — Tunicates, Hagfish and Lampreys, Oh My The Jaw Emerges — Fish With Cartilage — Fish With Bone — From Water To Land — Amphibians Live In Two Worlds — The Egg And A Split — Birds Are Reptiles — Furry, Milky Mammals — Humans and Neoteny

Dec 6 (Tu) Reading Day

Dec 9 (F) **FINAL EXAM 3:30 – 5:30 pm RITA 273**

**NOTE:** Discussion section begins August 31.
**Course requirements & Course Points**

In Class Exams: 300 Pts.
Final Exam (half cumulative): 250 Pts.
Discussion syllabus:
- Quizzes (on OAKS) 50 Pts.
- Discussion activities, in class assignments 30 Pts.
- Skill development assignments 65 Pts.
- Discussion Project 1 Evolutionary Ecology 130 Pts.
- Discussion Project 2 Ecology and Conservation 75 Pts.
- Discussion Project 3 Biodiversity 75 Pts.
- Discussion Presentations 25 Pts.

**Total points:** 1000 Pts.


**Extra Credit**

I will offer potential extra credit options all of minor point value. One option will be announced shortly before the final exam. In addition, you may attend and report on seminars relevant to Biology 211 topics. Primarily, these are Biology Department or Grice Marine Lab seminars.

A maximum of 6 seminars would count as extra credit. NOTE: These extra credits are a token to encourage general campus/civic involvement. *Your time is better spent studying for an exam than doing extra credit!!*

I will announce in lecture the seminars with content appropriately associated with 211 – but times generally include:
1) Monday 12-1 seminars in RITA
2) Friday afternoon seminars at Ft. Johnson Auditorium at Ft. Johnson / Grice Marine Lab on James Island

To receive credit you must hand in a typed 5 sentence summary of the seminar that you participated in which also includes a description of what you learned from this seminar. In general, a seminar will be worth about 3 points of extra credit.
DISCUSSION SYLLABUS
Biology 211 Fall 2022
Dr. Matt Rutter
rutterm@cofc.edu
Section D06: Wednesday 10:45am – 1:45 pm
RITA 271

Discussion section includes weekly in-class activities and longer-term research projects to accompany with major themes from throughout the course in Ecology, Evolution, Conservation and Biodiversity. Assignments will include both independent and group work. Please see lecture syllabus for additional information regarding discussion sections. The syllabus schedule is subject to change, especially in the event of a hurricane, and any amendments will be announced. Find materials for readings of papers on OAKS.

Student Learning Outcomes

At the end of this course, students are expected to be able to:

- describe the processes by which populations of organisms change in size
- explain the forces that lead to evolutionary change in populations and diversification among species
- interpret phylogenetic trees to comprehend the evolutionary relationships they depict
- discuss how interactions with the physical environment and with other organisms influence populations and communities
- build a foundation of knowledge about life’s diversity and its interrelatedness
- apply ecological and evolutionary principles to the conservation of biodiversity
- apply the following skills used by professional biologists: use primary literature, generate scientific questions and pose testable hypotheses, analyze data to evaluate hypotheses, use quantitative models to describe biological processes, and communicate these to a scientific audience.

If you have one, bring a laptop or tablet with MS Excel loaded to each discussion section. MS Excel, word and power point are available through Office365 for CofC students at portal.office.com and entering your CofC email and MyCharleston password. Download and installation can take a bit, give yourself plenty of time for the install prior to class.
Project 1: Citizen science: Learning experimental design through ecological and evolutionary interactive projects. Developing skills in science communication, including communication of data.

Project 2 Evolutionary ecology of a model genetic organism: Arabidopsis plants in response to environmental treatments. Skills developed: hypothesis development in ecological genetics and mutation/population genetics variation, data collection, metadata, statistics, graphing, literature search, written project in scholarly lab-report format...student authored datalines in public database for CURE (course based research experience).

Project 3 Biodiversity, logical hotspots and conservation: Collecting data about biodiversity and learning about global biological hotspots

Typed Discussion Questions (DQ): Hand in a typed paper copy of three questions (no extensions) based on the reading, due at the end of the discussion period. All other assignments are due at the beginning of class and will otherwise be considered late. Powerpoint presentations are due on OAKS 30 minutes prior to the class start-time. Details of projects and all associated handouts will be provided during discussion. Quizzes will also occur on OAKS or during discussion and will be announced.

Note, this schedule may change. Any updates to the syllabus will be announced!

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Discussion Activity</th>
<th>Due in Discussion</th>
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</thead>
</table>
| 1    | August 31 | Welcome Introduction to majors/minors in biology  
Asking biological questions  
How to write a discussion question |                                                                                  |
| 2    | Sept 7  | Plagiarism discussion  
Primary literature exercise  
Literature databases work  
Discuss Suarez and Case | Read: Suarez and Case (on OAKS), have access to a copy in class (DQ due)  
**Critical thinking:** Hand in categorized biological questions assignment |
| 3    | Sept 14 | **Project 1:** Introduction to citizen science (discussion, online projects)  
Choose citizen science activity  
Make a data collection plan and submit to instructor  
Intro to powerpoint best practices  
**Project 2:** Pre-activity focus group | Quiz: complete quiz on OAKS on population growth  
Read: articles on Oaks (DQ) |
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| 4  | Sept 21 | **Project 2**: Introduction to *Arabidopsis*  
Collecting early life history plant data  
Data and metadata lab notebook skills | **Read**: *Arabidopsis* background material  
**Quiz**: complete quiz on OAKS on *Arabidopsis* background |
| 5  | Sept 28 | Meet with instructor to discuss citizen science data collection, also time to collect data | **Quiz**: Species Interactions problems  
**Critical thinking**: Data collection for citizen science project  
**Communication**: 1pg Writing – put references to use |
| 6  | Oct 5  | Answering a question powerpoint  
What goes into a scientific introduction?  
Meet with citizen science group | **Communication**: Answering a question powerpoint (upload to OAKS)  
**Communication**: Write an introduction assignment |
| 7  | Oct 12 | **Project 1**: Group presentations of citizen science findings | **Quiz**: complete on Oaks  
**Communication**: Citizen science presentations |
| 9  | Oct 19 | **Project 2**: Second plant measurement  
Phylogeny practice | **Communication**: Written project for Project 1 citizen science  
**Data management**: Data & metadata in electronic form |
| 10 | Oct 26 | **Project 2**: Discuss lab report  
**Project 2**: Statistics and Graphing of *Arabidopsis* data  
**Project 3**: introduction & hotspots and iNaturalist | **Data skills & critical thinking**: Statistics and Graphing video with Bumpus bird data assignment (find URL for information on OAKS) |
| 11 | Nov 2  | **Project 3**: Research hotspot  
*Stono Preserve Field trip (tentative date)* | **Read**: Conservation paper (DQ) |
**Course requirements & Course Points**

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</tr>
<tr>
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<td>75 Pts.</td>
</tr>
<tr>
<td>Discussion Presentations</td>
<td>25 Pts.</td>
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</table>

**Total points:** 1000 Pts.