

Biodiversity, Ecology and Conservation Biology
Biology 211
College of Charleston, Department of Biology
Fall 2017

Lecture: 211 (sections 03, 04) TuTh 9:25 am-10:40 am room SSMB 138

Discussion: 211-D03 Tuesday 1:30-4:30pm. Room: Lightsey 340

211-D04 Thursday 1:30-4:30pm. Room: Lightsey 340

Instructor: Dr. Matthew (Matt) Rutter

Office: SSMB 152

Office Phone: 843-953-7113

Email: rutterm@cofc.edu (best way to reach me)

Office hours: 11am-noon Wednesday and by appointment

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, we 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: Biological Science 6th edition, Freeman

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. I adhere to the College of Charleston Absence Policy, as described in the student handbook. 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. 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). All excuses must be documented via the Dean of Undergraduate Study.

Note-taking: I consider note taking an important skill to develop as a student. I will provide outline hand outs and 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.

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 result in 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.

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 SSMB 152, or in mailboxes in the Biology office in SSMB (office hours are 8:30-4pm weekdays).

Computers: All assignments will be required to be completed on a word processor (or other necessary software (e.g. Excel saved in version MS 2010, Powerpoint MS 2010, etc). There are computer labs in the Addlestone library, 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, IM, use Facebook 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. The last row is too loud from hallway noise – don't sit there. **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 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

Aug 22 (Tu) – **Introductions** – What is Biology 211 all about? – The Age of Biology – Genomic Discoveries and Ecological Destruction -- The Diversity of Life and Its Uncertain Future
Readings: Ch 1

Aug 24 (Th) – **Introduction to Conservation Biology and Evolving Populations** – Changing Habitats -- Changing Climate – Hope? – From Genes to Populations and Beyond! – Defining Evolution – Darwin’s Big Ideas
Readings: Ch 54, 22

Aug 28 (M) **Last day of Drop/Add**

Aug 29 (Tu) – **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
Readings: Ch 22

Aug 31 (Th) –**Selection and Population Genetics** – Catching Selection in the Act -- Nothing Makes Sense (Except) -- Myths and Misperceptions -- Four Modes – What Happens When Nothing’s Happening
Readings: Ch 23, Bioskill 4

Sep 5 (Tu) – **Evolutionary Process** –Direct, Stabilized & Disruptive -- Sex Changes Everything -- Drifting at Random – Immigration: Genes Go With the Flow – Mutants!
Readings: Ch 23

Sep 7 (Th) **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
Readings: Ch 49 & 51

Sep 12 (Tu) – **Population Growth and Human Ecology**– A Carrying Capacity Applies the Brakes – Depend on Density? -- Cycling – Structure -- Oh the Humanity – Population Ecologists: Cassandra with Theoretical Models
Readings: Ch 51

Sep 14 (Th) **Community Ecology and Competition** -- Interacting species – Get Off My Niche! -- Lotka and Volterra Walk Into A Room, But Can They Coexist? -- Of Isoclines and Certain Extinction – Displaced Characters
Readings: Ch 52

Sep 19 (Tu) –**Predation, Herbivory and Parasitism** -- Are Predators in Charge? – Multiple Motives for Mimics – The Cycle of Life -- The Math of Eating --Why is the World

Green? – The Best Defense: Tasting Bad -- The Sick and the Dead – Admiring the Parasites

Readings: Ch 52

Sep 21 (Th) – **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

Readings: Ch 52

Sep 26 (Tu) – **EXAM I**

Sep 28 (Th) **Community Structure** -- Clements, Gleason, and Finding Succession – Disturbed – Putting Numbers on Diversity – How to be Stable and Productive – The Puzzle of Tropical Diversity

Readings: Ch 52 & 54

Oct 3 (Tu) **Ecosystem Ecology** — Forests – Deserts – Tundra – Lakes, Ponds and Wet Places – The Ocean – Productivity, Distributed

Readings: Ch 49 & 53

Oct 5 (Th) **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

Readings: Ch 53

Oct 10 (Tu) **Origins of Biodiversity and Phylogeny introduction** – The Species Concept, Warts and All – Allopatry: Changing After a Breakup – Sympatry: Living Together, Growing Apart -- Species A & Species B, K-I-S-S-I-N-G -- Read a Phylogeny!

Readings: Ch 24, and Bioskill 13

Oct 12 (Th) **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

Readings: Ch 25

Oct 17 (Tu) **FALL BREAK**

Oct 19 (Th) **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

Readings: Ch 26

Oct 24 (Tu) **Bacteria and Archaea** -- So Many Lifestyles – Marching through Bacteria -- Evolution and Drug Resistance -- Meet the Archaea
Readings: Ch 26

Oct 26 (Th) **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
Readings: Ch 27

Oct 31 (Tu) **Protists and Plants** — Apicomplexans, Parabasalids and Other Oddities – All Algae Are Not Alike – How Green Are Your Algae?

Readings: Ch 27, 28

Last day to withdraw with a grade of “W”

Nov 2 (Th) **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

Readings: Ch 28

Nov 7 (Tu) **EXAM II**

Nov 9 (Th) **Gymnosperms & Angiosperms** — PlantLand -- Flowers – The Beautiful Revolution – Ovaries – Exquisite Mutualisms and Other Manipulations – Monocots, Yes, But Dicots?

Readings: Ch 28

Nov 14 (Tu) **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?

Readings: Ch 29, 30

Nov 16 (Th) **Animals – Major Themes** – Sponges Are Animals??? – Layered Tissues, Symmetry, Guts and Development -- The Animal Tree – Animal Sex and Life Cycle – Choanoflagellates-- Porifera

Readings: Ch 30

Nov 21 (Tu) **Animals: Diploblasts, Acoelomorphs and Protostomes** — Cnidaria – Ctenophera – Acoelomorpha -- Racing Rotifers – Platyhelminthes are Flat – Segments Bring Power To Annelids – Mollusca: From Edible to Smart

Readings: Ch 30 and 31

Nov 23 (Th) **Thanksgiving Break**

Nov 28 (Tu) **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

Readings: Ch 31 and 32

Nov 30 (Th) **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

Readings: Ch 32

Dec 5 (Tu) Reading Day

Dec 7 (Th) FINAL EXAM 8-11am SSMB 138

NOTE: Discussion sections begin August 29.

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.
<u>Total points:</u> 1000 Pts	

Grading Policy: A: 93-100, A-: 90-92; B+: 87-89, B: 83-86, B-: 80-82, C+: 77-79, C: 73-76, C-: 70-72, D+: 67-69; D: 63-66, D-: 60-62, F: <59, other aspects of grading follow CofC standards.

Extra Credit

I will offer potential extra credit options all of *minor* point value. A *maximum* of 7 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 RHSC
- 2) Friday 3-4 pm 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.