

## **Evolution, Form, and Function of Organisms (Biol 112-10, Spring 2018)**

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<b>Lectures:</b>	M,W,F 2:30-3:20, Harbor Walk West 217
<b>Instructor:</b>	Professor Courtney Gerstenmaier
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<b>Office Hours:</b>	M,W,F: 3:30-4:20 in HWWE 309 or by appointment

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**Course Overview:** This general education science course provides a background for understanding and evaluating contemporary topics in biology and societal/environmental issues. Students develop a general understanding of core concepts and develop the critical competencies that form the bases for the practice of science and use of scientific knowledge. During our semester, we will address fundamental principles in biology including evolution, plant and animal structure and function, and biological systems. These ideas will be explored in the following concepts: evolutionary processes, origins of life, biodiversity, plant form and function, animal form and function, and ecology. For more information see the General Education Syllabus on OAKS.

### **Instructional Objectives:**

- Students will understand the nature of scientific knowledge and the scientific methods of discovery
- Students will learn factual knowledge about evolution, physiology, and ecology
- Students will think about applications of course material (to improve thinking, problem solving, and decisions)
- Students will have an appreciation of related applications to real-life of the theories they learn

### **Student Learning Outcomes:**

- Students will demonstrate knowledge of plant and animal physiology, evolution, and ecology
- Students will be able to identify and use basic vocabulary of evolution, ecology, conservation biology, anatomy and physiology of plants and animals
- Students will develop a scientific attitude
- Students will be able to effectively conduct scientific analysis and communicate about scientific problems
- Students will be able to apply physical/natural principles to analyze and solve problems
- Students will be able to discover the impact of science on society
- General Education Student Learning Outcomes can be found on our OAKS page under the syllabus folder

**Required Materials:** Biological Science 6th edition by Scott Freeman et al.

**Prerequisite:** Biology/Honors 111/151, or a high grade in Biology 101.

**Co-requisite:** Biology 112 Lab

## COURSE ASSIGNMENTS

**Tests:** We will have three tests and a final cumulative exam (with some new material) that will be administered during the lecture portion of the course. These tests are designed to assess your knowledge of the subjects covered. They will consist of multiple choice, true-false, fill in, and short answer questions.

**Class Reading Quizzes and Assignments:** These will be online quizzes and assignments administered through our OAKS website.

**Class Discussions:** During this course we will be using case studies, polls, and quizzes to begin our exploration into various topics. These tools will provide us with a jumping off point for exploring abstract topics and making them more relatable. During that discussion we will be using Poll Everywhere to answer questions and prompt discussion. This system works through your cell phones, so please bring them to class everyday. Participation grades will be based partly on participating actively in polling responses.

**Science in the News Paper:** This is a short 2-page paper that summarizes an interesting science article that you find in the scientific press and discusses how the scientific finding either relates to your life or impacts human society. The goal of this assignment is to discover the connection between science and our daily lives.

**Presentation:** At the beginning of each class, 1 student will present “fun” information relevant to cellular and molecular biology (<5 minutes). This could be a short video, a talk about a recent finding in the news, a poem, or any other “fun” activity. Students will sign up for a presentation date at the beginning of the course (these will be posted on OAKS) and should plan to arrive 5-10 minutes before class on the day of their presentation. Be sure that your “fun” activity differs from previously presented activities. At the end of the semester the class will select their favorite presentations and awards will be presented!

Note: Missing an assignment, test, or final without permission from the instructor will result in a zero. Make-up assignments/tests/finals will not be given except under extenuating circumstances. If the student cannot be present, they are expected to contact the instructor BEFORE the assignment/test/final and will be asked to obtain an official excuse from the dean of undergraduate affairs office before rescheduling. Whether the student is allowed to make-up the assignment/test/final is entirely at the discretion of the instructor regardless of a letter from the dean

**Grading of Assignments:** The following criteria will be used to calculate the grade.

Three In-class Exams:	35%
Final Exam (cumulative):	25%
OAKS Assignments:	15%
Science in the News Paper:	12%
Short Presentation:	8%
Participation:	5%

**Grading Scale:**

	B+: 87-89	C+: 77-79	D+: 67-69	
A : 93-100	B : 83-86	C : 73-76	D : 63-66	F: <59
A-: 90-92	B- : 80-82	C- : 70-72	D- : 60-62	

Other aspects of grading follow the CofC standards. The last day of drop/add is Tuesday, January 16<sup>th</sup>. The last day to withdraw with a grade of “W” is Tuesday, March 13<sup>th</sup>.

**ONLINE COURSE COMPONENTS**

**OAKS:** This is the College of Charleston’s course management system. It is an integral part of many of our courses and we will be making use of it during the semester. OAKS is where any supplemental class readings, notes, news, powerpoints, etc. will be located. *New to Oaks?* Get up to speed fast with tutorials here: <http://blogs.cofc.edu/oaks/students/getting-started/>

**Poll Everywhere:** This is a program that works through cell phones, tablets, and computers to gain live feedback during lectures. We will be using this as part of our in class discussions, so please bring a device that works with the program to class.

**STUDENT SUPPORT**

**Office Hours:** Please come see me if you need any additional help in my class, the lab or are just looking for some general advice about your academic path here at the college. I have scheduled office hours on Monday, Wednesday, and Friday that will occur after our class in Harbor Walk Room 309. I will also happily meet you in my office at 65 Coming St. by appointment.

**Supplemental Instruction (SI):** I encourage you to attend your SI sessions. These sessions offer you the chance to discuss course concepts, develop study strategies, work problems, and review notes with students who have already taken the course.

**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.

**Student Accommodations:** Any student eligible for and needing accommodations because of a disability are requested to speak with the professor during the first two weeks of class or as soon as the student has been approved for services so that reasonable accommodations can be arranged. For more information visit: <http://disabilityservices.cofc.edu/index.php>

**COURSE POLICIES**

**Attendance:** Attendance in lecture will set you on the road to success in this course and will be taken. Lecture is an excellent time to ask questions and participate in an active discussion of topics and hands on activities. You can miss three lectures before it will begin to negatively

impact your grade. Miss lecture? Get notes and handouts from another student. 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 d from scheduled exam time). All excuses must be documented via the Dean of Undergraduate Study. Stay tuned in lecture for announcements about posting of critical information on OAKS including hand outs, study guides, extra credit opportunities, and online quizzes.

**Classroom Courtesy:** A movie theater and a classroom might not have much in common except when it comes to the distraction of electronic devices. Students are asked to keep all electronic devices on silent and cell phones out of sight unless being used for Poll Everywhere questions. No electronics will be allowed during exams. Exceptions will be made in extreme situations such as spouses anticipating the birth of a child or a serious emergency. Permission to leave an electronic device on should be obtained prior to class.

**Academic Integrity:** Students are expected to behave in an honest and responsible manner. Violations of the honor code are offensive and will generally be dealt with severely. We will adhere to the following policy as quoted from the Honor Council’s recommended guidelines: “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. The student may also be placed on disciplinary probation, suspended (temporary removal) or expelled (permanent removal) from the College by the Honor Board.

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>

## LECTURE SCHEDULE

The material in this syllabus is subject to scheduling changes.

<b>Date</b>	<b>Topic</b>	<b>Reading</b>
Jan 8 – Mon	Introduction	
Jan 10 – Wed	Evolution by Natural Selection	Ch. 22
Jan 12 – Fri	Evolution by Natural Selection continued	
Jan 15 – Mon	<b>No School Martin Luther King Day</b>	
Jan 16 – Tue	Last Day of Drop/Add	
Jan 17 – Wed	Evolutionary Processes	Ch. 23
Jan 19 – Fri	Evolutionary Processes continued	
Jan 22 – Mon	Evolutionary Processes/Speciation	Ch. 24
Jan 24 – Wed	Speciation	
Jan 26 – Fri	Speciation continued	
Jan 29 – Mon	Exam Review	
Jan 31 – Wed	<b>Exam 1</b>	
Feb 2 – Fri	Plant Form and Function	Ch. 34
Feb 5 – Mon	Plant Form and Function continued	
Feb 7 – Wed	Vascular Transport	Ch. 35
Feb 9 – Fri	Vascular Transport	
Feb 12 – Mon	Plant Nutrition and soils	Ch. 36
Feb 14 – Wed	Plant Nutrition and soils	
Feb 16 – Fri	Plant Sensory Systems	Ch. 37
Feb 19 – Mon	Plant Sensory Systems	
Feb 21 – Wed	Angiosperm reproduction	Ch. 38
Feb 23 – Fri	Angiosperm reproduction	
Feb 26 – Mon	Exam Review	
Feb 28 – Wed	<b>Exam 2</b>	
Mar 2 – Fri	Animal Form and Function	Ch. 39
Mar 5 – Mon	Animal Form and Function	
Mar 7 – Wed	Osmoregulation	Ch. 40
Mar 9 – Fri	Osmoregulation	
Mar 12 – Mon	Animal Nutrition	Ch. 41
Mar 13 – Tue	Last Day to Withdraw with a “W”	
Mar 14 – Wed	Animal Circulation	Ch. 42
Mar 16 – Fri	Animal Circulation (Tentative) <b>Paper Due</b>	
Mar 19 – Mon	Spring Break	
Mar 21 – Wed	Spring Break	
Mar 23 – Fri	Spring Break	
Mar 26 – Mon	Animal Nervous System	Ch. 43
Mar 28 – Wed	Animal Nervous System	
Mar 30 – Fri	Animal Sensory System	Ch. 44
Apr 2 – Mon	Exam Prep	
Apr 4 – Wed	<b>Exam 3</b>	

Apr 6 – Fri	Animal Movement	Ch. 45
Apr 9 – Mon	Animal Movement	
Apr 11 – Wed	Hormones	Ch. 46
Apr 13 – Fri	Animal Reproduction	Ch. 47
Apr 16 – Mon	Animal Reproduction	
Apr 18 – Wed	Animal Immune System	Ch. 48
Apr 20 – Fri	Animal Immune System	
Apr 23 - Mon	<b>Final Exam Review</b>	
Apr 30 – Mon	<b>Final Exam from 12-3 pm</b>	

## **Introduction to Cell and Molecular Biology/Evolution, Form, and Function of Organisms**

**BIOL 111 & 111L/BIOL 112 & 112L**

**Department: Biology**

### **Learning Goals & Objectives**

This general education science sequence provides a background for understanding and evaluating contemporary topics in biology. Students develop a foundational understanding of core concepts to use and on which to expand in upper level courses. They also develop the critical competencies that form the bases for the practice of science and use of scientific knowledge.

### **Core Concepts**

This 2-semester course sequence in general biology addresses fundamental principles in biology to prepare students for sophomore and upper level courses in biology:

- **EVOLUTION:** The diversity of life evolved over time by processes of mutation, selection, and genetic change. The theory of evolution by natural selection allows scientists to understand patterns, processes, and relationships that characterize the diversity of life.
- **STRUCTURE AND FUNCTION:** Basic units of structure define the function of all living things. Structural complexity, together with the information it provides, is built upon combinations of subunits that drive increasingly diverse and dynamic physiological responses in living organisms. Fundamental structural units and molecular and cellular processes are conserved through evolution and yield the extraordinary diversity of biological systems seen today.
- **INFORMATION FLOW, EXCHANGE, AND STORAGE:** The growth and behavior of organisms are activated through the expression of genetic information at different levels of biological organization and depend on specific interactions and information transfer.
- **PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamic and will be explored to understand how living systems operate, how they maintain orderly structure and function, and how physical and chemical processes underlie processes at the cellular level (i.e. metabolic pathways, membrane dynamics), organismal level (i.e. homeostasis) and ecosystem level (i.e. nutrient cycling).
- **SYSTEMS:** Living systems are interconnected and interacting and biological phenomena are the result of emergent properties at all levels of organization, from molecules to ecosystems to social systems. The course will explore the dynamic interactions of components at one level of biological organization to the functional properties that emerge at higher organizational levels.

The specific topics covered in each course include:

Biology 111 & Biology 111L

- Chemical and physical properties of life
- Cell form & function
- Energetics, metabolism, and photosynthesis
- The cell cycle
  - Mitosis and cell reproduction
  - Meiosis and sexual reproduction
- Mendelian genetics / Patterns of inheritance
- Human Inheritance
- The molecular basis of inheritance
- DNA and protein production
- Regulation of gene expression
- Some aspects of biotechnology

Biology 112 & Biol 112 L

- The development of evolutionary thinking
- Basic evolutionary processes
- Comparative plant form & function
- Comparative animal form & function

**Core Competencies**

- **Nature of Scientific Knowledge**
  - Understand the intellectual standards used by scientists to establish the validity of knowledge, evidence, and decisions about hypothesis & theory acceptance. These standards include: 1) science relies on external and naturalistic observations, and not internal convictions; 2) scientific knowledge is based on the testing of hypotheses and theories, which are under constant scrutiny and subject to revision based on new observations; 3) the validity of scientifically generated knowledge is established by the community of scientists through peer review and open publication of work.
  - Understand that new ideas in science are limited by the context in which they are conceived; are often rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly, through contributions from many investigators.
  - Understand that science operates in a world defined by the laws of chemistry and physics.
  - Understand the differences and relationships among scientific theories, hypotheses, facts, laws, & opinions.
  - Understand the differences between science and technology, but also their interrelations.
  - Understand the dynamic (tentative) nature of science.
- **Scientific Methods of Discovery**



- <sup>1</sup>Understand the methods scientists use to learn about the natural world (observing; questioning; formulating testable deductive hypotheses; controlled experimentation when possible; observing a wide range of natural occurrences and discerning (inducing) patterns).
- Apply physical/natural principles to analyze and solve problems.
- **Develop a Scientific Attitude**
  - Develop habits of mind that foster interdisciplinary and integrative thinking (within biology; between biology and other sciences; between science and other disciplines).
  - Develop an appreciation for the scientific attitude - a basic curiosity about nature and how it works.
- **Develop scientific analysis and communication skills**
  - Develop quantitative reasoning skills (quantitatively expressing the results of scientific investigations, or patterns in nature and using knowledge of biological concepts to explain quantitatively-expressed data or patterns).
  - Understand the probabilistic nature of science and the use/application of inferential statistics to test hypotheses.
  - Develop scientific information literacy (library, internet, databases etc...); find and evaluate the validity of science-related information.
  - Communicate scientific knowledge, arguments, and ideas in a variety of different contexts (scientific, social, cultural), utilizing a variety of different media (scientific articles, policy statements, editorials, oral presentations etc.).
  - Develop cooperative problem-solving skills (working effectively in teams), but also habits of mind and skills that foster autonomous learning.
- **Develop an appreciation for the impact of science on society.**
  - Develop an appreciation of humans as a part of the biosphere and the <sup>2</sup>impact of biological science on contemporary societal/environmental concerns.
  - Knowledge of the history of the biological sciences and the influences of politics, culture, religion, race, and gender on the scientific endeavor.

### **Signature assignments for measuring learning outcomes**

#### **Learning Outcome 1: Students apply physical/natural principles to analyze and solve problems.**

This learning outcome is assessed using the poster (or scientific article) generated in Biology 112 lab as part of the multi-week student-directed independent research project. In this project students use data they collect (or has been collected in actual research investigations) to test an hypothesis of their choosing. These projects may be themed, with all student groups addressing different aspects of a larger question, emphasizing the interdependence of various research groups needed to address complicated problems. This

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<sup>1</sup> This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can apply physical/natural principles to analyze and solve problems.*

<sup>2</sup> This learning goal will be measured as part of the general education assessment. The specific learning outcome to be measured is: *Students can demonstrate an understanding of the impact that science has on society.*

multi-week project begins the class identifying what questions need to be addresses in the larger problem. Individual student groups then become experts in these areas of the larger problem. The smaller research teams develop a hypothesis, and write a research proposal to test their hypothesis. Students collect (or use already collected data), summarize and statistically analyze the data, and draw conclusions.

**Learning Outcome #2** - Students demonstrate an understanding of the impact that science has on society.

**Biology 112 lab** Students produce a written document based on one of the case-based labs (examples - policy statement, article, stake-holder professional letter or poster) that requires them to research and apply biological knowledge or evidence to defend or critique a proposed solution to a biology-related societal issue. Although the choice of the specific issue or proposed solution is course-section specific, some examples of potential issues include

- exploring environmental/health impacts of genetically modified organisms
- the use of performance enhancing drugs in sports
- the development of antibiotic resistance in disease organisms