

**Evolution, Form and Function of Organisms - BIOL 112.08 (CRN 21316)**  
**Syllabus and Schedule, Spring Semester 2019**

**Class location and schedule:** RITA 154, Tue/Thu, 9:25 – 10:40 AM

**Instructor:** Dr. Antony (Tony) S. Harold, Grice Marine Laboratory (GML), College of Charleston, 205 Fort Johnson, Charleston, SC 29412. Telephone (843) 953-9180; fax (843) 953-9199; email harolda@cofc.edu

**Office and mailbox locations:** GML Annex, Rm. 125. Mailbox located in GML 102.

**Office hours:** By appointment only in RITA 226/228; preferred times are Wed 11:30 AM – 12:00 noon or Friday 10:00 – 11:00 AM, or Wed/Fri afternoons in Grice 125. Please email Dr. Harold for an appointment.

### **Supplemental Instruction**

We have supplemental instruction scheduled for this class. Your **SI Leader** is Shem Navarro (email navarrosf@g.cofc.edu). Days and times for Supplemental Instruction (SI) will be determined early in the semester. You are strongly encouraged to attend SI once a week.

### **Course Description**

This is a course for biology majors covering life and living systems. It will emphasize the evolution, form and function of organisms. The course should help prepare you for upper level courses in organismic biology.

### **Student Learning Outcomes**

1. Demonstrate an understanding of the basics of evolutionary theory; how populations evolve and the causes.
2. Use fundamental population genetics to show evolutionary change in populations.
3. Relate the basic structures of plants and animals to how they function in organisms.
4. Demonstrate an understanding of the functioning and interactions among organ systems in plants and animals.
5. Be able to compare plant and animal adaptations to environments particular to life on land.

### **Policies and Requirements**

1. This course will be conducted in accord with the Honor Code (see Student Handbook).

#### **2. Attendance Policy**

You are expected to attend all meetings of the class. More than five unexcused absences will result in a grade of WA for the course. Students reporting an absence should go to the Office of the Dean of Students to fill out the appropriate form. A representative from that office will notify the instructor by e-mail.

### 3. Electronic Devices

The use of cell phones, laptops and other electronic devices during class is a distraction to both instructors and other students; to be fair to all those concerned they must not be in use while class is in session. Consequently, all electronic communications devices (e.g., cell phones, tablets, laptop computers) must be silenced and put away. The use of a cell phone for any purpose during a test will be treated as a violation of the Honor Code.

### 4. Disabilities

If there is anyone in the class who has a documented disability and has been approved to receive accommodations through the Center for Disability Services / SNAP, please discuss this with the instructor at the beginning of the course.

### 5. Required Textbook

Biological Science, 6th Edition, by Freeman. (you must have the 6th edition)

### 6. Summary of Tests/Exams

Test 1: First quarter of the course.

Test 2 (Mid-term exam): **Cumulative** – All material covered in the first half.

Test 3: **Non-cumulative** - Material covered in the third quarter only (after the Mid-term exam).

Test 4: Fourth quarter, **non-cumulative**.

Final Examination: **Cumulative** – All material covered in the course.

### 7. Proportional value of graded work

A. Test 1	15%
B. Test 2 (Mid-term exam)	20%
C. Test 3	15%
D. Tests 4	20%
E. Final Examination; cumulative	25%
F. Participation (attendance, adherence to course policies)	05%

### 8. Grading scale

A	94-100%	B-	80-83%	D+	67-69%
A-	90-93%	C+	77-79%	D	64-66%
B+	87-89%	C	74-76%	D-	60-63%
B	84-86%	C-	70-73%	F	<60%

## 9. COURSE SCHEDULE AND REQUIRED READINGS

**Readings<sup>1</sup>** are chapter numbers in the course textbook *Biological Science*, 6th Ed., by Freeman (2017)

<b>Date</b>	<b>Topic</b>	<b>Readings<sup>1</sup></b>
<b>January</b>		
Tue 08	Introduction to organismal biology; Evolution by Natural Selection	1, 22
Thu 10	Evolution by Natural Selection	22
Tue 15	Evolution by Natural Selection	22
Thu 17	Evolutionary processes and populations	23
Tue 22	Evolutionary processes and populations	23
Thu 24	Speciation	24
Tue 29	Speciation	24
Thu 31	Introduction to Phylogeny	25
<b>February</b>		
Tue 05	<b>TEST 1</b>	
Thu 07	Plant Form and Function	34
Tue 12	Plant Form and Function; Transport	34, 35
Thu 14	Transport in Plants	35
Tue 19	Plant Nutrition and soils	36
Thu 21	Plant Sensory Systems	37
Tue 19	Plant Reproduction and Development	38
Thu 21	<b>TEST 2</b>	
Tue 26	Animal Form and Function	39
Thu 28	Animal Form and Function	39
<b>March</b>		
Tue 05	Animal Nutrition	41
Thu 07	Animal Nutrition	41
Tue 12	Water and Electrolyte Balance in Animals	40
Thu 14	Gas Exchange and Circulation	42
Tue 19	Spring Break	
Thu 21	Spring Break	
Tue 26	Nervous Systems	43
Thu 28	<b>TEST 3</b>	
<b>April</b>		
Tue 02	Animal Sensory Systems	44
Thu 04	Animal Movement	45
Tue 09	Animal Movement	45
Thu 11	Animal Reproduction and Development	47
Tue 16	The Immune System in Animals	48
Thu 18	<b>TEST 4</b>	
Tue 23	Review; In-class time to complete on-line course evaluation (you will need to use your own device)	
Thu 25	<b>FINAL EXAMINATION: RITA 154, 8:00 – 11:00 AM</b>	

## **Introduction to Cell and Molecular Biology/Evolution, Form, and Function of Organisms BIOL 111 & 111L/BIOL 112 & 112L**

**Department: Biology**

### **General Education 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 & Biology 112L

- 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 multi-week project begins the class

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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.*

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