Biology 112: Evolution, Form and Function of Organisms

Section 6 MWF 9:00 - 9:50 PM RITA 101

Course Syllabus

Instructor Deb Bidwell

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Course Description:

- A foundation course for science majors providing an introduction to evolution with an emphasis on the structure, form and function of plants and animals. Students will be exposed to lectures, activities, readings, discussions, videos, and assessment to ensure a thorough, lasting understanding of the material. Completion of this class and the associated laboratory meets a General Education requirement. Please see the addendum at the end of this syllabus.

Pre-requisites

- Successful completion of Biology/Honors 111/151, or a high grade in Biology 101. Biology 112 laboratory is normally a co-requisite, unless students already have credit for the laboratory portion of the course.

Course Learning 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.

Contact/Communication:

Private/Student-To-Instructor Contact

- Students should contact me about issues that are specific to the student **by email at bidwelld@cofc.edu**
- My response turn around time with emails will typically be **within 24 hours on weekdays and within 48 hours on weekends.**

General Student-To-Instructor and Student-To-Student Contact

- Students should contact the Instructor and other students on issues that are not student-specific and may benefit or apply to the entire class using the **Discussion Board Hallway Conversations open 24 hours a day, 7 days a week.**
- My response turnaround time on the hallway conversations discussion board will typically be **within 24 hours weekdays and within 48 hours on weekends.**

Office Hours

- In person office hours (drop-in/group) in **RITA 229: Mondays and Wednesdays 2:30-4:30 PM or by appointment.**

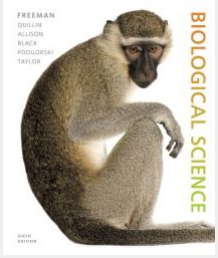
Course Communication and Community Building

- **OAKS** will be utilized for **content, quizzes, news, updates.** *New to Oaks?* Get up to speed fast with tutorials here: **http://blogs.cofc.edu/oaks/students/getting-started/**
- **Email** will be used to communicate important or sudden changes in course information.
- We will **all work together to build our classroom and online learning community.** I will play a facilitating role in helping you get to know, work with, trust, and collaborate with the other members of our class. Each member of the class must be willing to participate in a dynamic, and engaging learning group that is inclusive. Your participation, willingness to contribute, and your initiative are paramount to having a successful and enjoyable learning experience. We **aim to develop a spirit of camaraderie and team learning that will unite us** as a community of learners.

Expectations

- Students should plan to **log into Oaks at least 2 times per week.**
- Students should dedicate **6+ hours per week** to this course to be successful.
- This class is **student-driven**. Motivation must come from the student.
- We cover the fundamentals in class, lower on **Bloom's Taxonomy**. Students are expected to master this material, and be able to work with it in order to understand, apply, analyze, evaluate, and create – higher on Bloom's Taxonomy. Recommended homework, quizzes, supplemental instruction and student effort will facilitate. See BIOSKILLS 18 on pages 53-54 for more information.
- Our class should be **interactive and engaging**! Students are expected to **contribute** to our **learning community.**
- **There are weekly obligations**: quizzes, graded assignments, or exams.
- **Laptops or tablets are not allowed in class** unless a need for accommodation is documented/discussed with the Instructor. Research clearly indicates that note taking by hand is a superior method of learning. You may audio record lectures, but please ask first.
- Please keep **phones** silenced and away during class time.

Required Course Materials



- **Computer/technology** with access to **internet**
- **Software/Apps**: (OAKS, PowerPoint)
- **Textbook**: Freeman, Biological Science 6th edition (used is great!)
- **#2 Pencil(s)** on exam days
- Basic scientific **calculator** (with exponents & square roots)

Supplemental Instruction and student teaching

- We have supplemental instruction scheduled for this class. Your SI leaders are **Grant Dixon and Emma Dooley**
- Days and times for Supplemental Instruction (SI) will be determined early in the semester.
- SI is for everyone! You are strongly encouraged to attend once a week.
- We are also fortunate to have **Connor Wes**t with us this semester. Connor is a third year Biomedical PhD candidate at MUSC who is doing a teaching externship with us this semester.

Participation

- There is no formal attendance requirement, but you will not do well if you do not attend class. You, +/or someone that loves you, is paying a considerable sum of money to be in class. Make the most of the opportunity. We have 42 classes together this semester. I will not waste your time or money.

Late work

- Late homework assignments are accepted up to 1 week and lose 5% for each day late.
- Late quizzes are not permitted without formal documentation and prior approval due to official College travel, weddings, funerals. Excused absences due to serious medical issues spanning the entire quiz period may be considered for exemption on a case by case basis.

Inclement weather

- In the event of cancelled class(es) due to inclement weather, make up lectures will likely be online lectures through OAKS VoiceThread.

Accommodation

- SNAP students, disabled students, veterans, parents, commuters, nontraditional students, athletes, International, ESL, and all students with life circumstances that may warrant accommodations are encouraged to **discuss any concerns with the Instructor** in a timely manner. I am fluent in Spanish. I understand that we all have way more important things going on in our lives than this biology class. I aim to be friendly, approachable, and understanding. But I will challenge you, and I will hold you to high standards.

Honor Code and Academic Integrity:

- We will adhere tightly to the CofC honor code. Lying, cheating, attempted cheating, unauthorized collaboration, keeping personal electronics such as cell phone or smart watch on your person during an exam, and plagiarism, whether intentional or not, are all clear violations of our Honor Code and will be reported to the Honor Board. For complete details regarding our updated honor code please see the following link: **http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php**

Assessment:

- Formative assessment quizzes are multiple-choice, individual, timed, randomized, approximately 15 questions, and conducted through OAKS. They are open-book and open-notes but students must study and prepare ahead of time, as quizzes are challenging and there will not be time to look up individual answers. The syllabus quiz counts toward quiz average (everyone should earn 100%).
- Exams (summative assessment) will be in-class short answer/multiple choice exams emphasizing higher order cognition (see text page 53 re: Bloom's Taxonomy.)
- Graded assignments will be submitted electronically to the OAKS drop box. These assignments are focused on promoting a connection to local nature and introducing primary scientific literature.

Grades calculated as follows:

Component	Value (% of final course grade)
Quizzes(8 of 10) lowest two scores dropped, syllabus quiz counts.	**30**
Exams (3)	**40**
Cumulative Final Exam	**20**
Graded assignments (3)	**10**
Total:	**100%**

Grading scale:

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	**less than 60**

Tentative Schedule for section 6 MWF class:

Week	**Lecture topic**	**Chapter readings**	**Other readings for class, fun +/or exam extra credit**	**Due for grading**	**Suggested homework** (not collected or graded)
1/9 to 11	Intro, syllabus, Natural Selection	Review Chp 1 Big Picture 1 Read BIOSKILLS 15-18	Why would nature favor these insane adaptations?	**Syllabus quiz due 1/14** (OAKS online) must earn 100% unlimited tries.	Carefully read the syllabus (OAKS) Meet and learn names of three new people in class
1/14-18	Natural Selection and Evolution	22, 50.3	Tibetans inherited high altitude gene from ancient human	**Quiz 1** (OAKS online) opens F 1/18 closes T 1/22 Average up to 3 tries	Myth-busters: misconceptions about evolution (OAKS)
No class Monday 1/21 1/23-25	Evolution and Speciation	23	Genetic manipulation the first 50,000 years	**Quiz 2** (OAKS online) opens F 1/25 closes M 1/28 Average up to 3 tries	Hardy Weinberg Equilibrium problems (OAKS) Look ahead to selfie #1
1/28-2/1	Finish up evolution **Exam 1**	24.1-24.2	The gene that jumped	**Selfie #1 Adaptation due W 1/30 to drop box** **Exam 1 F 2/1**	Study for exam 1
2/4-8	Plant structure, function, transport	34, 35	"What Plants Talk About" NOVA movie, likely viewed in class.	**Quiz 3** (OAKS online) opens F 2/8 closes M 2/11 Average up to 3 tries	
2/11-15	Plant nutrition and response	36, 37	Wood-wide web	**Quiz 4** (OAKS online) opens F 2/15 closes M 2/18 Average up to 3 tries	Water potential problems (OAKS)
2/18-22	Plant reproduction	38	Pollinating secrets of a bee's buzz	**Quiz 5** (OAKS online) opens F 2/22 closes M 2/25 Average up to 3 tries	Draw and label a flower. Draw and label the cycle of alternation of generations.
2/25-3/1	Plant repro., development, sustainability and agriculture. **Exam 2**	38, 21	Climate and chocolate, World may be running out of cocoa farmers.	**Selfie #2 Secondary growth due W 2/27 to dropbox.** **Exam 2 Friday 3/1**	Study for exam 2
3/4-8	Intro to animal form and function, nutrition	39, 41	Immortal jellyfish	**Quiz 6** (OAKS online) opens F 3/8 closes M 3/11 Average of up to three tries	Draw and label human digestive tract. List enzymes produced in each area.
3/11-15	Animal gas exchange and circulation	42	How to hold your breath for 20 minutes		Draw and label a mammal heart, show how blood moves. Compare and contrast arteries, veins, capillaries. Diagram how fish gills work.
3/18-22 **no class**	**<----------S P**	**R I N G**	**B R E A K ---------**	**----------→**	
3/25-29 **3/25, last day to withdraw**	Animal osmoregulation	40	The blood harvest	**Quiz 7** (OAKS online) opens F 3/29 closes M 4/1 Average of up to three tries	Draw, label kidney nephron w/role of each segment. Label permeability to water/ions for each segment.

4/1-5	Animal nervous system and neuromuscular junction	43, 45	Girl who feels no pain	**Quiz 8** (OAKS online) opens F 4/5 closes M 4/8 Average of up to three tries	Describe how a toxin blocking the release of acetylcholine would affect you. A toxin blocking the closing of Na+ channels?
4/8-12	Animal reproduction & development **Exam 3**	47, 21	Evolution of the scrotum Birth control reliability NY Times	**Exam 3 Friday 4/12**	Understand menstruation monthly cycle.
4/15-19	Animal immunity	48	Journey to science from an anti-vaxxer	**Assignment #3, Primary Literature Worksheet due 4/17 to dropbox** **Quiz 9** (OAKS online) opens F 4/20 closes M 4/23	
last day of class is Tuesday 4/23	Wrap up. Course evals, review for final.		Stem cells, regeneration and plasticity	**Course evaluations in class. Extra Credit packet due.**	
	CUMULATIVE	**FINAL EXAM**	**MONDAY**	**APRIL 29**	**8-11 AM**

Addendum: General Education information:

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:

<u>Biology 111 & Biology 111L</u>

- 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

<u>Biology 112 & Biol 112 L</u>

- 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**
  - [1]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 [2]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.

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[1] 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.*

[2] 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.*

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 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