

Biology 112: Evolution, Form and Function of Organisms

Section 3 MWF 3:00 - 3:50 PM SSMB 129

Course Syllabus

Instructor Deb Bidwell

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Spring 2018

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. An emphasis on sustainability literacy is included in this course through a unit on water and soil health with a focus on sustainable agriculture. 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.

QEP Sustainability Literacy Learning Outcome:

- Students should be able to identify various elements of sustainability and the relationships between them.

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 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 be **within 24 hours weekdays and within 48 hours on weekends.**

Office Hours

- In person office hours (drop-in/group) in **SSMB 140: Fridays 9:00AM – 12:00PM or by appointment.**

Course Communication and Community Building

- **OAKS** will be utilized for **content, quizzes, discussions, news, updates, and online office hours.** *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.
- This semester we will be doing some group discussion work online using discussion boards through OAKS. **As your instructor and facilitator I'll require you to make OAKS discussion posts about our course readings, as well as expecting you to thoughtfully reply to several of your peers' comments.** You can find a **rubric** about the expectations for quantity and quality of online discussion comments on OAKS.
- **Netiquette:** In our course discussions, we will be using complete sentences and proper grammar and will **not be using abbreviations or slang the way we do while texting on the cell phone.** Because it is difficult to interpret tone from only written text and our online communication in the OAKS discussion boards will lack facial expression, body language, hand gestures and other social clues, it is especially important that we all take care to be sensitive to possible tone misinterpretation which can inadvertently lead to isolation rather than inclusion. **We will all need to make sure that we are thoughtful, respectful, friendly, professional and considerate in our posts.** For example, when we challenge each other's ideas (which we will want to do!), it is vital that we do not allow disagreement to become personal. We can disagree in a respectful, intellectual way that still allows for us to work well and collaborate together.

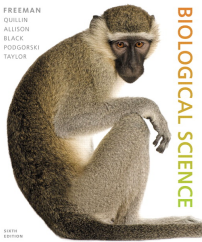
Expectations

- 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, written discussions, 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 calculator** (with exponents & square roots)

Supplemental Instruction

- We have supplemental instruction scheduled for this class. Your SI leader is **Madi Methvin**
- 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.

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, are paying a considerable sum of money to be in class. Make the most of the opportunity. I will not waste your time or money.

Late work

- Late discussion posts and peer replies lose 10% for each day late.
- Late quizzes are not permitted without formal documentation/prior approval

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%). Conscientious, best effort completion of both sustainability pre (start of semester) and post (end of semester) quizzes will also count as one quiz grade of 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.)
- Writing assignments will be submitted electronically as discussion posts or dropbox uploads made through OAKS, may require peer feedback, and will be evaluated according to a rubric. Resources for locating and citing references are available on OAKS in the content area.

Grades calculated as follows:

| <u>Component</u> | <u>Value (% of final course grade)</u> |
|---|--|
| Quizzes(7 or 8) lowest score dropped | 25 |
| Exams (4) | 40 |
| Cumulative Final Exam | 20 |
| Written assignments (2) | 15 |
| Total: | 100% |

Tentative Schedule for section 3 MWF class:

| Week | Lecture topic | Chapter readings | Other Readings for written assignments or exam Extra Credit | Due for grading | Suggested homework (not collected or graded) |
|---|--|---|---|---|--|
| 1/8 to 12 | Intro, syllabus, Natural Selection | Review Chp 1 Big Picture 1 Read BIOSKILLS 15-18 | | Syllabus quiz (OAKS online) must earn 100% unlimited tries. Sustainability pre-quiz. (Link through OAKS). | Carefully read the syllabus (OAKS) Meet and learn names of two new people in class |
| No class Monday 1/15 1/17&19 | Natural Selection and Evolution | 22 | Why would nature favor these insane adaptations? | Quiz 1 (OAKS online) opens F 1/19 closes M 1/22 Average of up to three tries | Myth-busters: misconceptions about evolution (OAKS) |
| 1/22-26 | Evolution and Speciation | 23 | Science gets a grip on wrinkly fingers | Quiz 2 (OAKS online) opens F 1/26 closes M 1/29 Average of up to three tries | Hardy Weinberg Equilibrium problems (OAKS) |
| 1/29-2/2 | Finish up evolution, exam 1, start plants | 24.1-24.2, 34 | Tibetans inherited high altitude gene from ancient human | Exam 1 W 1/31 | Study for exam 1 Look ahead to written assignment 1. |
| 2/5-10 | Plant structure, function, transport | 34, 35 | Genetic manipulation the first 50,000 years and The gene that jumped – both required for written assignment 1 | Written assignment 1: Tech and ethics of genetic modification. Post due F 2/10 peer replies due M 2/12 | Carefully read assignment directions and rubric (OAKS) before completing written assignment. |
| 2/12-16 | Plant nutrition and response | 36, 37 | Wood-wide web | Quiz 3 (OAKS online) opens F 2/16 closes M 2/19 Average of up to three tries | Water potential problems (OAKS) |
| 2/19-23 | Plant reproduction | 38 | Pollinating secrets of a bee's buzz | Quiz 4 (OAKS online) opens F 2/23 closes M 2/26 Average of up to three tries | Draw and label a flower. Draw and label the cycle of alternation of generations. |
| 2/26-3/2 | Plant repro., development, sustainability and agriculture. Exam 2 | 41 | | Exam 2 Friday 3/2 | Study for exam 2 |
| 3/5-9 | Intro to animal form and function, nutrition | 39, 41 | Immortal jellyfish | Quiz 5 (OAKS online) opens F 3/9 closes M 3/12 Average of up to three tries | Draw and label human digestive tract. List enzymes produced in each area. Look ahead to written assignment 2. |
| 3/12-16 | Animal gas exchange and circulation | 42 | Climate and chocolate, World may be running out of cocoa farmers – both required for written assignment 2 | Written assignment 2. Due in OAKS drop box by Friday 3/30. Read assignment and rubric carefully before completing. | Draw and label a mammal heart, show how blood moves. Compare and contrast arteries, veins, capillaries. Diagram how fish gills work. |
| 3/19-23 no class | <-----S P | R I N G | B R E A K ----- | -----> | |

| | | | | | |
|--------------------------------------|--|-------------------|--|---|--|
| 3/27-31 | Animal osmoregulation | 40 | The blood harvest | Quiz 6 (OAKS online) opens W 3/31 closes M 4/2 Average of up to three tries | Draw, label kidney nephron w/role of each segment. Label permeability to water/ions for each segment. |
| 4/2-6 | Animal nervous system and neuromuscular junction | 43, 45 | Girl who feels no pain | Quiz 7 (OAKS online) opens F 4/6 closes M 4/9 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? |
| 4/9-13 | Animal reproduction | 47 | Evolution of the scrotum Birth control reliability NY Times | Exam 3 Friday 4/13 | Understand menstruation monthly cycle. |
| 4/16-20 | Animal immunity | 48 | Journey to science from an anti-vaxxer | Quiz 8 (OAKS online) opens F 4/20 closes M 4/23 | |
| last day of class is Mon 4/23 | Wrap up. Course evals, review for final. | | Stem cells, regeneration and plasticity | Course evaluations in class. Sustainability post quiz due by final exam. | |
| | | | | | |
| | CUMULATIVE | FINAL EXAM | FRIDAY | APRIL 27 | 4-7 PM |

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:

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**
 - ¹Understand 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 ²impact 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

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.*

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