

BIOLOGY 101-01 CRN 20088
CONCEPTS AND APPLICATIONS IN BIOLOGY
SYLLABUS SPRING 2020

Instructor: Dr. Andy Shedlock, Biology Department

Class Time / Location: MWF 10:00-10:50AM RITA 101

Office Hours: 11am-12pm M & F, RITA lobby or TBA

Email = shedlockbiol@gmail.com (DO NOT USE shedlockam@cofc.edu)

Textbook: We will not use any particular textbook in our 101 lecture. Slide sets used in lecture will be made available to students on OAKS. You will need to use WiFi internet access via laptop to function in our section of the class.

OAKS: All course material will be managed on OAKS, including videos and quizzes. This means you need to make sure you can function with your laptop on OAKS in order to function effectively in the class. Check OAKS daily for updated info and announcements.

Attendance Policy: *You cannot do well in the course if you do not attend class.*

Attendance is assumed and participation is essential if you expect to earn a good grade.

SCHEDULE: There are 12 full MWF weeks of classes that form the course schedule.

Establish collaborative “Theme Teams” based on Random.org assignments into working groups. Each week a pair of student teams will collaborate to teach the class on Friday.

WEEKLY INTEGRATIVE THEMES

1. Scientific literacy and intellectual self defense in the age of the internet.
2. Evolution as a force of nature. Fact yes. Theory yes. Belief system no.
3. Origins of life. Chemical evolution and the RNA world.
4. Cosmic evolution and astrobiology.
5. The Central Dogma.
6. Gene regulation and expression.
7. Genomics, precision medicine, and synthetic biology.
8. Biodiversity. What is it, where does it come from, why should we care?
9. Ecosystem health, pollution, population growth.
10. Plants! Agriculture, water, and food security.
11. Climate change, carbon cycle, notes from the fossil record and oceanography.
12. Green economy, sustainability literacy, environmental problem solving.

Experiential Active Learning Pedagogical Statement

Our section of Biology 101 is built upon major themes of public interest that are relevant to sustainable human welfare and rooted in concepts of evolutionary, molecular, and cellular biology. We will strengthen our scientific literacy and apply it to think critically, collaborate productively, communicate effectively, and solve problems creatively (The 4 C's). This method of discovery requires curiosity and imagination and a sense of pride in ownership of your original ideas and novel course material. For this reason our syllabus is a process-oriented, student-driven, multi-disciplinary vehicle based on a highly successful active learning model that integrates STEAM fields (Science, Technology, Engineering, Art, and Math). This shared experiential approach to education contrasts with the traditional content-heavy fact-oriented didactic lecture model (which has proven to be much less effective for teaching science over the past 100 years and is especially outdated in the age

of the internet). This means YOU are going to drive the course forward week by week as a diverse group of interactive collaborative explorers, not passive consumers.

Weekly Student Collaborative Theme Team Format

-Each Friday Collaborative Team A will produce an edited 15-min video based on one of 12 weekly themes to be presented in class

-A five-question T/F quiz written by Team A based on their video presentation will be taken on OAKS in class on Fri

-A second Collaborative Team B will lead an interactive peer-driven discussion of the video material presented by Team A in class immediately after the class views the presentation and completes the quiz.

-We will review and “grade” each quiz and video in class via Q&A discussion led by Team B.

Weekly MWF Class Format

Mondays: Instructor will introduce and “anchor” the weekly theme based on application of fundamental concepts to understanding modern real-world issues that depend on scientific literacy and critical thinking in biology. Weekly theme teams will begin organizing their presentation.

Wednesdays: Instructor will emphasize fundamental concepts in evolutionary, cell, and molecular biology that are relevant to the weekly themes. Weekly collaborative teams will continue preparing for the Friday group presentation, quiz, and discussion. Instructor will work interactively with multiple groups in process.

Fridays: Weekly collaborative theme team video presentations, quizzes and in-class reviews via peer-to-peer Q&A discussion

Your final grade will be based on 1000 points:

200 points Mid-term Exam 1 (based on fundamental concept lecture material)

200 points Mid-term Exam 2 (based on fundamental concept lecture material)

200 points Final Exam (based on the content of the weekly student videos and discussions)

200 points Group Video Presentations and In-class Participation (requires attendance)

200 points Quiz Scores (10-week highest total + 2 weeks extra credit)

THERE ARE NO MAKE-UP QUIZZES

Earned Letter Grade Scale for the Course

≥90% Guarantees A- or higher

≥80% Guarantees B- or higher

≥70% Guarantees C- or higher

≥60% Guarantees D- or higher

<60% = F

Other official stuff that is required to be included on this syllabus...

Honor Code and Academic Integrity

<http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php>

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. Students may have the opportunity to meet with the Dean of Students and may be brought before the Honor Board. Depending on the severity, incidents may lead to a written intervention, a XF in the course indicating failure of the course due to academic dishonesty, disciplinary probation, suspension (temporary removal) or expulsion (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.

Parity Statement

Any student eligible for and needing academic adjustments or accommodations through the SNAP program because of a documented disability is requested to speak with the professor in a timely and confidential manner so that your needs can be addressed. Athletes, International or ESL students are encouraged to discuss any concerns with the Instructor in a timely manner.

Official BIOL 101/L – 102/L Course Learning Goals and Objectives (Re, SACS COC Accreditation)

Learning Goals & Objectives

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.

Core Concepts

This 2-semester course sequence in general biology addresses fundamental principles in biology which broadly may include:

- 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 transformation 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).
- Biological 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.

These ideas are explored from the perspective of the following topics in each course:

BIOL 101 & 101L

- Chemical and Physical Properties of Life
- Evolution as a unifying principle in biology
- Cell Form & Function
- Energetics and Metabolism
- The Cell Cycle
 - Meiosis and Sexual Reproduction
 - Mitosis and Cell Reproduction
- Mendelian Genetics
- Patterns of Inherited Traits
- Human Inheritance
- The Molecular Basis of Inheritance
- DNA and protein production
- Regulation of gene expression
- Biotechnology

BIOL 102 & 102 L

- Evolutionary Processes
- Origins of Life
- Biodiversity
 - Viruses, Bacteria and Archaeans
 - "Protist" Lineages
 - Plants
 - Fungi
 - Animals
- Plant Form & Function
- Animal Form & Function
- Principles of Ecology

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 outcome of the testing of hypotheses and theories that 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 the real world as defined by the laws of chemistry and physics.

-Understand the differences between and relations among a scientific theory, hypothesis, fact, law, & opinion.

-Understand the differences between science and technology but also their interrelations.

-Understand the dynamic (tentative) nature of science.

· Scientific Methods of Discovery

-Understand the methods scientists use to understand 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.
 - Developing 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.
 - Developing 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...); finding and evaluating the validity of science-related information.
 - Communicate scientific knowledge, arguments, ideas in a variety of different contexts (scientific, social, cultural) and 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

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 102 lab as part of the multi-week student-directed independent research project. In this project students use ecological data they collect (or which has been collected in actual research investigations) to test an ecological hypothesis of their choosing. This multi-week project begins with students becoming experts in various areas of ecological sampling. Students, working in small research teams, decide on a question they would like to explore. Teams then develop a research proposal to test their hypothesis. Students collect (or use already collected data), summarize and analyze the data, and draw conclusions.

Learning Outcome #2: Students demonstrate an understanding of the impact that science has on society. BIOL 102 lab students produce a written document (examples - policy statement, article, stake-holder professional letter or poster) which 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 epidemic of diabetes in the United States
- solutions for mitigating global climate change

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

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