

Concepts/Applications in Biology I (Biol 101-07, Fall 2018)

Lectures:	M,W,F 2:00-2:50 Rita Lida Hollings Science Center Rm 154
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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

Instructional Objectives:

- Students will understand the nature of scientific knowledge and the scientific methods of discovery
- Students will learn factual knowledge about genetics, basic cellular processes, and molecular biology
- 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 be able to identify the different biological molecules and their functions in living organisms
- Students will become familiar with the diversity, structure, and function of cellular organelles
- Students will comprehend how living organisms acquire energy from the environment and how energy is converted into different forms through processes of photosynthesis, cellular respiration, and fermentation
- Students will demonstrate an understanding of cell division including both mitosis and meiosis
- Students will demonstrate understanding of the basics of Mendelian genetics
- Students will demonstrate an understanding of the mechanisms of DNA replication, RNA transcription, and RNA translation
- General Education Outcomes can be found on our OAKS page

Required Materials: Biology: Concepts and Applications by C. Starr et al. 9th ed.

Prerequisite: None

Co-requisite: Biology 101 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, and matching questions.

Class Reading Quizzes and Assignments: These will be online quizzes and assignments administered through our OAKS page that are related to the course readings.

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 phone, so please bring them to class. 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.

Student Symposium: At the end of the semester we will have a student symposium in which you will do a short presentation about a topic we covered in the course and how it relates to us. I will provide additional information as it draws near.

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: A single grade based on performance in both the lecture and lab will be assigned for this 4-credit course. The following criteria will be used to calculate the grade.

Three In-class Exams:	20%
Final Exam (cumulative):	20%
Class Reading Quizzes:	10%
Science in the News Paper:	10%
Short Presentation	10%
Class Discussions:	5%
Laboratory Grade:	25%

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 Monday, August 27th. The last day to withdraw with a grade of “W” is Wednesday, October 24th.

Extra Credit: I will offer potential extra credit with a **maximum 5%** value added to your lowest exam score. NOTE: These extra credits are a token to encourage general science involvement. *Your time is better spent studying for an exam!!* Extra credit must be submitted by the last day of lectures (December 3rd 2018) to be considered. Before you start I strongly advise you to come and see me to discuss the specifics of the assignment.

Option 1) *A 1-page review of a recent news headline you think was misrepresented. This requires a comparison of the news report with the original science paper and a discussion why you think the science paper was misrepresented.*

**worth 1% can do up to 5*

Option 2) *A 1-page review of a lecture, talk, paper, or other activity attended outside of class. I will provide details for some opportunities in class, but feel free to ask me if something qualifies. Potential options include: [Biology Department Seminars](#), [Holland Lifelong Learning Seminars](#), Darwin Week, and [the Fort Johnson Marine Science Seminars](#).*

**worth 1% can do up to 5*

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.

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. I will also happily meet you in my office at 65 Coming St. by appointment.

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 is 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: While attendance is not mandatory it is an essential component of the course. The most beneficial parts of this course are going to occur through our in-class discussions. These discussions are factored into your grade and attendance will be measured through participation in the poll questions.

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>

Laboratory Safety: Policy can be found in your laboratory syllabus and on our OAKS page under the syllabus folder.

Tentative Schedule

Date	Topic	Readings
Aug 22 – Wed	Introduction	
Aug 24 – Fri	The Science of Biology	Ch 1
Aug 27 – Mon	The Science of Biology	Ch 1
Aug 29 – Wed	The Chemical Basis of Life	Ch 2
Aug 31 – Fri	No Class - Chemical Basis of Life Activity	Ch 2
Sept 3 – Mon	The Chemical Basis of Life	Ch 2
Sept 5 – Wed	The molecules of Life	Ch 3
Sept 7 – Fri	No Class - Molecules of Life Activity	Ch 3
Sept 10 – Mon	Molecules of Life	Ch 3
Sept 12 – Wed	Molecules of Life/Review	
Sept 14 – Fri	Exam 1	
Sept 17 – Mon	Cell Structure	Ch 4
Sept 19 – Wed	Cell Structure	Ch 4
Sept 21 – Fri	Metabolism	Ch 5
Sept 24 – Mon	Metabolism	Ch 5
Sept 26 – Wed	Respiration	Ch 7
Sept 28 – Fri	Respiration	Ch 7
Oct 1 – Mon	Respiration	Ch 7
Oct 3 – Wed	Photosynthesis	Ch 6
Oct 5 – Fri	Photosynthesis	Ch 6
Oct 8 – Mon	Photosynthesis	Ch 6
Oct 10 – Wed	Review	
Oct 12 – Fri	Exam 2	
Oct 15 – Mon	DNA Structure	Ch 8
Oct 17 – Wed	DNA Structure	Ch 8
Oct 19 – Fri	Protein Synthesis	Ch 9
Oct 22 – Mon	Protein Synthesis	Ch 9
Oct 24 – Wed	Control of Gene Expression	Ch 10
Oct 26 – Fri	Mitosis	Ch 11
Oct 29 – Mon	Mitosis	Ch 11
Oct 31 – Wed	Meiosis	Ch 12
Nov 2 – Fri	Meiosis Science in the News Paper Due	Ch 12
Nov 4 – Mon	Fall Break	
Nov 7 – Wed	Review	
Nov 9 – Fri	Exam 3	Ch 14
Nov 12 – Mon	Mendel and Trait Inheritance	Ch 13
Nov 14 – Wed	Mendel and Trait Inheritance	Ch 13

Nov 16 – Fri	Human Inheritance	Ch 14
Nov 19 – Mon	Human Inheritance	Ch 14
Nov 21 – Wed	<i>Thanksgiving Break</i>	
Nov 23 – Fri	<i>Thanksgiving Break</i>	
Nov 26 – Mon	Biotech	Ch 15
Nov 28 – Wed	Biotech	Ch 15
Nov 30 – Fri	Student Symposium	
Dec 3 – Mon	Student Symposium	

Final Exam: Wednesday, December 12th from 12-3pm

Table 2. Schedule of Assignments – all work is graded on a 100 point scale.

Week	Lab	Team Earned Points	Individually Earned Points		Readings/Tutorials
			¹ Quizzes & other individual work	² Homework	
Aug 27	Lab 1 – Termite Trails	-	-	-	Post-lab Readings: - Lab Manual Appendices B & C - Textbook: Ch. 1.5-1.8
Sep 3	Lab 2 – What’s Alive?	TLN Lab 2	- Quiz over course syllabus	-Termite Trails rewrite (see lab manual pg. 4-5) - Pre-Lab 2 What’s Alive Worksheet (see lab manual pg. 7-8)	Pre-lab Reading: - Textbook: Ch. 1.1-1.4 & 1.9. More detailed information to complete the homework worksheet can be found in Chapt. 2-5
Sep 10	Lab 3 – Osmosis & Diffusion: Part 1	TLN Lab 3 – Part 1	- Quiz over Lab 2	- Pre-Lab 3 Osmosis Lab Case Study Worksheet (see lab manual pg. 23)	Pre-lab Textbook Reading: Ch. 4.3 & 5.6-5.8
Sep 17	Lab 3 – Osmosis & Diffusion: Part 2 Lab 4 – Exploring Plant Metabolism	TLN Lab 3 – Part 2 TLN Lab 4	- Inferential Statistics Quiz	- Pre-Lab 3 Part 2 M&M Statistics Worksheet (see lab manual pg. 37)	Pre-lab Readings: - OAKS Graphing & Statistics: Inferential Statistics - OAKS - Using the LabQuest2 Data Logger & CO ₂ Sensor Video Tutorial
Sep 24	Lab 5: Week 1 – Exploring Metabolic Diversity: Campus Plant Walk & Diversity Journal	TLN Lab 5:Week 1 - Plant Metabolism Journal	- Quiz over Labs 3 & 4	-Post-Lab 4 Plant Metabolism Lab Follow-up Worksheet (see lab manual pg. 47)	Pre-lab Readings: - Lab #4 Plant Metabolism & Productivity OAKS Tutorials - Textbook Chs. 5.1-5.5 & 6
Oct 1	Lab 5: Week 2 – Exploring Metabolic Diversity: The Research Proposal	Team Proposal & Proposal Peer Evaluation	-	-	-
Oct 8	Lab 5: Week 3 – Exploring Metabolic Diversity: Data Collection	-	-	-	-
Oct 15	Lab 5: Week 4 – Exploring Metabolic Diversity: Data Collection & Draft Article	-	-	-	Pre-Lab Reading: - Appendix D – Guide to Writing a Scientific Article
Oct 22	Lab 6 - Lost in Timbuktu	TLN Lab 6	-	-	Pre-Lab Reading: - See suggested background readings on lab manual pg. 74. - Lab 6 Gel Electrophoresis Tutorial
Oct 29	Lab 5: Week 5 – Exploring Metabolic Diversity: Peer Review of Draft Articles	Draft article peer-review & Scribe Summaries	- Quiz over Lab 6 - Independent Project Draft Article	-	-
Nov 5	Fall Break - No Labs this Week				
Nov 12	Lab 7 – Sickle Cell Anemia and Malaria	TLN Lab 7	-	- Pre-Lab 7 Mutations Table Worksheet (see pg. 91)	Pre-lab Reading: - Lab 7 OAKS Mutations Tutorial - Textbook Chs. 8 & 9
Nov 19	Thanksgiving – No Labs this Week				
Nov 26	Student Project Oral Presentations & Peer Evaluations of presentations	Team Project Presentation & Peer Review of other team’s presentations	- Sickle Cell Letter (see lab manual pg. 107)	- Final Independent Project Article (25% of final lab grade)	-

¹Quizzes will be over concepts from the previous week’s lab, and homework reading for that day’s lab.

²Homework is listed on the week it is due. Homework is due at the start of lab.

CONCEPTS AND APPLICATIONS IN BIOLOGY I & II
BIOL 101 & 101L/BIOL 102 & 102L
Department: Biology

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 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**

- ¹Understand 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.

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.*

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

Textbook: The text book (Biology: Concepts and Applications (currently - 8th Ed.) by Starr, Evers & Starr.