Biology 101: CONCEPTS AND APPLICATIONS IN BIOLOGY, Section 5 (4 credit hours)

Fall 2019
MWF 12-12:50am, RITA 101

Instructor: Amanda Kelley (she/her)
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Office: RITA 216
Office hours: Mondays and Fridays 1-2pm, and by appointment

After class help: Students are welcome to talk with me briefly after class, but for in depth questions, come to my office hours or email me to schedule an appointment. In your email, be sure to include your course and section in the subject line. I will also answer quick questions via email. You can expect a reply within 24hrs Monday through Friday, 8am-5pm. If you’re working through materials and have a lot of questions, do come see me in person rather than writing a long email.

Textbook: Biology: Concepts and Applications, 10th ed. Recommended but not required. Some materials covered in class will not be in the textbook.

Course Description and Objectives
Designed for non-science majors, BIOL 101 provides a background for understanding and evaluating contemporary topics in biology and societal/environmental issues. Subject matter includes chemical, molecular, and cellular processes, as well as respiration, photosynthesis, and genetics.

Students who successfully complete this course will gain an understanding in the methods and dynamic nature of science. Additionally, the material covered in this course will aid students in becoming informed citizens, comfortable with a variety of topics including genetics, basic cellular processes, molecular biology, and the process of scientific exploration. Ideally, this course will lead to a greater appreciation of the science of biology, as well as provide students with the tools to understand and interpret contemporary topics in biology (e.g. environmental issues, genetics).

Co-requisite: The associated, required laboratory is BIOL 101L.

Grading

Tests (3*15%) 45%
Attendance and participation 25%
Written assignment 5%
Final exam 25%

Tests are based on lecture material and will consist primarily of multiple choice questions. The final exam will take the same form as regular term tests, but will cover all topics from the semester. For each exam, you will need to provide your own scantron and number 2 pencil.

Written assignment
The details of the written assignment will be introduced in lecture.
Attendance & participation
Class attendance is essential to achieving a high grade in this course, as you will be actively discussing topics and completing team-based work during lecture. Students are responsible for all content for each class that is missed. Attendance marks cannot be made up. For excused absences, the weight may be redistributed.

Extra credit
For 3% extra credit, you may make a set of study cards and show them to me before the final exam. The cards must be hand written. Further details will be provided in lecture.

Missed tests
There will be no make ups for missed tests. If you have an excused absence (e.g., compassionate reasons, approved athletics), the weight of the test can be transferred to the final exam.

Re-grading
Requests for regrading must be made within one week of the work being returned. Students must return the original work and be prepared to justify the change, using the grading rubric/key. Test answers written in pencil cannot be re-graded.

Honor Code and Academic Integrity
Cheating, attempted cheating, and plagiarism are violations of our Honor Code that will be investigated when identified. Other forms of cheating include possessing or using an unauthorized study aid (which could include accessing information stored on or texted to a cell phone/device), 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. For complete details regarding our updated honor code please see the following link: http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php

OAKS
You have an assigned a College ID and an associated password for access to online resources, including the College of Charleston’s course management system (OAKS). I will post class announcements, grades, and other important information on OAKS throughout the term; check often for this important information. If you have trouble with OAKS, please email me.

In class expectations
Be respectful of the learning environment, and do not behave in a way that disrupts other members of the classroom. Silence your cellphone and refrain from using technology for non-course content. If you need to take a call or sleep, please step out. We will be discussing some potentially hot topics, so consider whether your comments will be hurtful before you voice them.

Preferred names and pronouns
I will gladly honor your request to address you by the name and gender pronouns of your choice. Please advise me of this early in the semester via your college-issued email account or during office hours so that I may make the appropriate notation on my class list.

Accommodations for Disabilities
To request classroom accommodation, you must first register with the Center for Disability Services at the beginning of the semester. This office will provide you with documentation that you will then
Food insecurity
Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable them to provide connection to any resources that they may have.

Tentative Schedule
We will use problems and case studies as a starting point for our topics this semester in order to provide a meaningful context for the science. Starting topics will likely bring together concepts from multiple textbook chapters. Because I want the course to reflect your interests, I may make changes to discussion topics based on your feedback.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture topics</th>
<th>Text chapter</th>
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<tbody>
<tr>
<td>4</td>
<td>Sept 9-13</td>
<td>The scientific method &amp; the nature of science, evolution</td>
<td>1, 16, 17</td>
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<td>5</td>
<td>Sept 16-20</td>
<td>Natural selection, convergent evolution, island biogeography</td>
<td>16, 17</td>
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<td>6</td>
<td>Sept 23-27</td>
<td>Endangered species, extinctions</td>
<td>44</td>
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<td>7</td>
<td>Sept 30-Oct 4</td>
<td>Climate change basics, coral reefs</td>
<td>44</td>
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<tr>
<td>8</td>
<td>Oct 7-11</td>
<td>Coral reefs, metabolism &amp; photosynthesis</td>
<td>5,6</td>
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<tr>
<td>9</td>
<td>Oct 14-18</td>
<td>Oct 14: No classes DNA</td>
<td>8,9</td>
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<tr>
<td>10</td>
<td>Oct 21-25</td>
<td>DNA, bioengineering, GMO foods</td>
<td>8,9,10, 15</td>
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<td>11</td>
<td>Oct 28 - Nov 1</td>
<td>Stem cells, the cell, the origin of life</td>
<td>4, 18, 28</td>
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<td>12</td>
<td>Nov 4-8</td>
<td>Mitosis, cancer</td>
<td>11</td>
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<td>13</td>
<td>Nov 11-15</td>
<td>Meiosis, the selfish gene</td>
<td>12</td>
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<td>14</td>
<td>Nov 18-22</td>
<td>Animal behaviour</td>
<td>15</td>
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<td>15</td>
<td>Nov 25</td>
<td>Review</td>
<td></td>
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<tr>
<td>16</td>
<td>Dec 2</td>
<td>Review (last day of classes)</td>
<td></td>
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From the College of Charleston course plan:

**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 & physical properties of life, evolution as a unifying principle in biology, cell form and function, energetics and metabolism, the cell cycle (meiosis and mitosis), mendelian genetics, patterns of inherited traits, human inheritance, the molecular basis of inheritance, DNA and protein production, regulation of gene expression, biotechnology.

**BIOL 102 & 102L**

Evolutionary processes, origins of life, biodiversity, plant and animal form and 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.

Developing an appreciation for the impact of science on society
• Develop an appreciation of humans as a part of the biosphere and the 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 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, stakeholder 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