Syllabus – Spring 2022
BIOLOGY 111 (17): Introduction To Cell and Molecular Biology
(CRN 20766.202220)
MWF 10:00am – 10:50am RITA 154

INSTRUCTOR:
Mrs. Emily Giarrocco, M.S.
giarroccoe@cofc.edu

Note: Please make sure to use your CofC email only when emailing me; I do my best to reply the same day if the email is received before 5 p.m., but I do not check my emails after 5 p.m. or over the weekend. Also, please include your course number and section number.

OFFICE LOCATION: 65 Coming St., Rm. 214 (across Coming St. from the loading dock area of RITA)
OFFICE HOURS: Mondays & Wednesdays 11:00am – 12pm (zoom or in-person; please notify in advance if possible). These are optional. You are also welcome to email me to schedule an appointment.

Course Description
This course is intended to be a foundation course for science majors, providing an introduction to evolution as well as plant & animal form, function, and basic physiology.
BIOL 111 and BIOL 111L are prerequisites for BIOL 112. BIOL 112L is a corequisite.

Supplemental Instruction (SI):
Supplemental Instruction, or SI, is a collaborative, peer-assisted group study session. It is for everyone and is not remedial. Attendance is strongly encouraged. Your SI leader for this course is Shem Navarro.
https://csl.cofc.edu/supplemental-instruction/

Required Course Materials
1. Textbook: Free online open access text Open Stax Biology 2e
https://openstax.org/details/books/biology-2e (please set up a student account)

2. Computer and online access: All students must have access to a computer equipped with a web camera, microphone, and Internet access. You will be required to download, install and use Respondus Lockdown Browser and Monitor for certain quizzes and possibly exams. Further instructions will be provided about this. Resources are available to provide students with these essential tools if they need assistance - please let me know if you need help accessing those resources. If you need a reminder of laptop requirements, please visit: https://it.cofc.edu/laptops/

Class materials require online access through MyCharleston to both OAKS and Voice Thread; make sure you’re familiar with both. If you’re new to OAKS, start here: http://blogs.cofc.edu/oaks/students/getting-started/. Another good resource for technology questions or help is: http://blogs.cofc.edu/sits/. The Remind app will also be used occasionally as backup to reach you.
**Suggested Course Material**

The **Study Guide** for *Biological Science* by Freeman, 7th Edition, (Pearson Publishers). This is not required, but it is usually available in the book store and is very helpful for many students. The Mastering Biology website that goes with the text also offers additional resources.

A physical notebook with paper and a writing utensil is *strongly* encouraged. If you need convincing: [https://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/](https://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/).

The **Center for Student Learning** (CSL) has resources to facilitate peer education through tutoring, supplemental education and development of skills that contribute to academic success. It’s also free to you! For more information, please visit the CSL website at [http://csl.cofc.edu](http://csl.cofc.edu) or drop by their location (first floor of the Addlestone Library).

**COVID-19**

The College of Charleston is committed to promoting the health and safety of our campus community. To that end, all faculty and students must abide by current COVID-19 protocols. At the commencement of this semester, in accordance with the Centers for Disease Control (CDC) and S.C. DHEC guidelines, the College of Charleston requires face coverings for all members of the campus community, regardless of vaccination status, while around others indoors in all of its campus facilities, including classrooms and laboratories. The mask requirement does not apply in a student’s own residence hall room or a faculty or staff member’s private office (if alone).

Regardless of how this policy might change over the course of the semester, I request you please wear a mask in my classroom as I have very young, unvaccinated children. Supporting your needs through absence or quarantine related to sickness is not an issue, I will have lectures available via zoom or VoiceThread, but you must communicate your needs. This also applies if you think you may be sick or have had a close contact. If you do have symptoms or were a close contact, PLEASE GET TESTED. It’s free. It’s quick. It could save someone from very serious complications. If several students test positive in the class, it is possible the course will be moved online for the duration of the quarantine period. Communication of illness will be essential so that alternate plans can be arranged. For obvious reasons, it is imperative that, even if ill or in difficult circumstances, the student finds a way to communicate in a timely manner. Therefore, all students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools.

Students should be aware that extended absences for any reason cannot be accommodated in every course. Missed assignments and assessments may result in poor or failing grades. If a student is absent from class for an extended period, a withdrawal (W) before the deadline should be strongly considered. In all cases, assigning course grades is the responsibility of the instructor consistent with the grading policy published on the syllabus.

**Inclement Weather, College Closure, and the Class Schedule**

If the College of Charleston closes and members of the community are evacuated due to inclement weather or for any other reason, students are responsible for taking course materials with them in order to continue with course assignments consistent with instructions provided by faculty. In cases of extended periods of institution-wide
closure where students have relocated, instructors may articulate a plan that allows for supplemental academic engagement despite these circumstances.

**Teaching Philosophy**

Student engagement and effective communication of both students and instructor are essential to a successful learning experience. In college, your responsibility toward your classes can be fueled by a variety of motivators, from enjoyment of the material, desire to succeed, or even simply worldview expansion. Whatever your motivator, it is your responsibility to learn the material, ask questions and explore available resources. As an instructor, I am here as a resource and guide.

**Course Policies and Requirements**

**Accommodations**

Any student in this class who has a documented disability should speak to me as soon as possible, as well as contact the Center for Disability Services (CDS/SNAP program), located on the first floor of the Lightsey Center, Suite 104, (843) 953-1431, SNAP@cofc.edu

The College of Charleston community is enriched by students of many faiths that have various religious observances, practices, and beliefs. We value student rights and freedoms, including the right of each student to adhere to individual systems of religion. The College prohibits discrimination against any student because of such student’s religious belief or any absence that results from held beliefs. Please contact me if this course’s schedule directly conflicts with one of your observances. Please see: https://academicaffairs.cofc.edu/documents/procedures-and-practices/statement-of-accommodation.pdf

**Class Delivery Format**

COVID-19 pandemic permitting, we will be having our lecture portion of class in person in RITA Room 154 unless notified otherwise.

This class will be administered through OAKS, the College of Charleston’s learning management system. To access OAKS go to http://my.cofc.edu and login to My Charleston. The OAKS icon is the acorn located in the upper righthand corner of the screen.

I expect you to regularly login to OAKS to check for course updates, complete quizzes, etc. Please also check your email regularly as I will send e-mail updates to the class through OAKS to update you on class events and assignments.

**Class Attendance**

Attendance of all scheduled meeting times for class is expected. If you miss a class, it is your responsibility to review materials from that day. I am also teaching this class asynchronously (online) and so will have VoiceThread lectures for you to review. Exams will be based primarily on lectures, but the textbook is an invaluable resource, so it is important to keep up with your readings which will be explicitly outlined on OAKS. As mentioned above, should a student in our class test positive for COVID-19, the entire course will be moved online for the duration of the quarantine & attendance will be measured by completion of the materials.
Expectations

- Students should plan to log into Oaks at least 3 times per week. Remember that I can see when you log into OAKS and will monitor your progress.
- Students should dedicate 6+ hours per week to this course to be successful.
- This class is student-driven. Motivation must come from the student.

Honor Code

Students are required to adhere to the guidelines outlined by the Honor Board in the Student Handbook (please see http://deanofstudents.cofc.edu/policies-and-procedures/honor-code-and-code-of-conduct.php) This includes lying, which will not be tolerated in this course. All work that you turn in for this course (whether for assignments, quizzes, or exams) must be your own independent scholarship. Students should be aware that unauthorized collaboration—working together without permission—is a form of cheating; this includes collaborating with classmates or other individuals on online quizzes or exams. 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. Any form of plagiarism (intentional and unintentional), cheating, or presenting someone else's work as one's own will be treated as a serious academic transgression and will be communicated accordingly by the instructor as an honor code violation to Student Affairs. Be especially cautious of plagiarism when using Internet sources. Cheating, attempted cheating, or plagiarism will result in a grade of zero on that assignment, quiz or exam and may result in a final overall grade of F or XXF (failure due to academic dishonesty) for the course.

Quizzes

Multiple choice quizzes will be given weekly and conducted through OAKS. They are intended to help students in keeping up with the large amount of information in this course by encouraging them to prepare and study/read(review EVERY day. It is your responsibility to keep up with due dates and times! A missed quiz will result in a 0 for that quiz, unless you talk to me to explain the situation (serious illness, including but not limited to COVID-19, family responsibilities, other extreme circumstances). It is imperative that you communicate with me and tell me the truth, so that I can work with you. Your lowest 3 quiz scores will be dropped in the final grade calculation. All cell phones, Apple watches, pagers, iPods, iPads, tablets, laptops, etc. are to be turned off and put away during each quiz, and you are expected to take them by yourself without other people, notes, books or websites (with the exception of the Syllabus Quiz). The use of any wireless communication device during a quiz, test, or final exam is a violation of the Honor Code.

Exams

In this course, there are 3 regular exams scheduled during the semester (see calendar below for dates) and 1 cumulative final exam scheduled during the final examination period. Anyone who misses an exam will receive a 0, unless you talk to me to explain the situation (serious illness, including but not limited to COVID-19, family responsibilities, other extreme circumstances). If you have any conflicts with the scheduled exams, you must see me ahead of time, well before the exam date. All cell phones, Apple watches, pagers, iPods, iPads, tablets, laptops, etc. are to be turned off and put away completely during each exam. The use of any wireless communication device during a quiz, test or final exam is a violation of the Honor Code.
Grading/Exams

You may check the Gradebook on OAKS throughout the semester. If you see a discrepancy or error in your grades, please contact me as early as possible. The sooner you bring it to my attention, the easier it is to fix.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Weight (% of total grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes/Homework (lowest 3 scores dropped)</td>
<td>20</td>
</tr>
<tr>
<td>Exams (3)</td>
<td>60</td>
</tr>
<tr>
<td>Cumulative Final</td>
<td>20</td>
</tr>
</tbody>
</table>

EXAMS
There will be four exams (including the final) spaced throughout the semester. The final exam will be comprehensive (and will be given during finals week) but will emphasize topics covered after Exam III. Exams will be mostly in multiple choice format but may also include some short answer/discussion questions. Much of the exams will be in SCANTRON format. A #2 pencil is not required.

QUIZZES
There will be weekly quizzes or homework assignments over the course of the semester. Since the lowest 3 quiz/assignment grades will be dropped, there will be no make-up quizzes or homework assignments. The quizzes will be due at the end of every week.

Letter grades are determined as follows:

\[
\begin{align*}
93\% & = A \\
90-92 & = A- \\
87-89 & = B+ \\
83-86 & = B \\
80-82 & = B- \\
77-79 & = C+ \\
73-76 & = C \\
70-72 & = C- \\
67-69 & = D+ \\
63-66 & = D \\
60-62 & = D- \\
\leq 59 & = F \\
0 & = XXF
\end{align*}
\]

Expectations

1. **Absolutely NO FOOD and NO DRINK in the classroom** and wear your mask properly (over both your mouth and nose).

2. Students are expected to be respectful of your teacher and other students. Talking, texting and computer uses other than note-taking are prohibited. Research has shown that learning is negatively affected when students and those around them use phones/electronic devices during class. Everyone deserves a learning-focused environment.

3. **Electronic device policy:** We may be using technology from time to time during lecture, but for the rest of the time I expect your phone to be on silent. If you forget to do so you **RISK BEING PERSONALLY REMINDED DURING CLASS** and you may be asked to leave and not to return that class period. During class, please do not take photos of my slides or video record the lectures.
<table>
<thead>
<tr>
<th>Day/Date</th>
<th>Topic</th>
<th>Chapter (Readings)</th>
<th>Due for Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Jan 10</td>
<td>Welcome, Overview of Syllabus, Intro</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Jan 12</td>
<td>Evolution by Natural Selection</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>F Jan 14</td>
<td>Evolution by Natural Selection</td>
<td>18</td>
<td>SYLLABUS QUIZ</td>
</tr>
<tr>
<td>M Jan 17</td>
<td>NO CLASS – MLK Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Jan 19</td>
<td>Evolutionary Processes and Speciation</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>F Jan 21</td>
<td>Evolutionary Processes and Speciation</td>
<td>18</td>
<td>QUIZ 1</td>
</tr>
<tr>
<td>M Jan 24</td>
<td>Evolutionary Processes and Speciation</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>W Jan 26</td>
<td>Population Evolution</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>F Jan 28</td>
<td>Evolution Case Study</td>
<td>See OAKS</td>
<td>QUIZ 2</td>
</tr>
<tr>
<td>M Jan 31</td>
<td>EXAM 1</td>
<td>18-19</td>
<td></td>
</tr>
<tr>
<td>W Feb 2</td>
<td>Plant Form &amp; Function</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>F Feb 4</td>
<td>Plant Form &amp; Function</td>
<td>30</td>
<td>QUIZ 3</td>
</tr>
<tr>
<td>M Feb 7</td>
<td>Water &amp; Sugar Transport in Plants</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>W Feb 9</td>
<td>Plant Responses</td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td>F Feb 11</td>
<td>Plant Nutrition</td>
<td>31</td>
<td>QUIZ 4</td>
</tr>
<tr>
<td>M Feb 14</td>
<td>Plant Reproduction</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>W Feb 16</td>
<td>Plant Reproduction</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>F Feb 18</td>
<td>Plant Case Study</td>
<td>See OAKS</td>
<td>QUIZ 5</td>
</tr>
<tr>
<td>M Feb 21</td>
<td>Plant Phylogenetics</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>W Feb 23</td>
<td>EXAM 2</td>
<td>30-32</td>
<td></td>
</tr>
<tr>
<td>F Feb 25</td>
<td>Animal Form &amp; Function</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>M Feb 28</td>
<td>Animal Form &amp; Function</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>W Mar 2</td>
<td>Animal Form &amp; Function</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>F Mar 4</td>
<td>Animal Nutrition</td>
<td>34</td>
<td>QUIZ 6</td>
</tr>
<tr>
<td>Mar 6 - Mar 12</td>
<td>SPRING BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Mar 14</td>
<td>Review, Animal Nutrition</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>W Mar 16</td>
<td>Animal Nutrition</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>F Mar 18</td>
<td>Animal Nervous System &amp; Neural Signaling</td>
<td>35</td>
<td>QUIZ 7</td>
</tr>
<tr>
<td>M Mar 21</td>
<td>Animal Nervous System &amp; Neural Signaling</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Subject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Mar 23</td>
<td>Animal Nervous System &amp; Neural Signaling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Mar 25</td>
<td>Animal Immune Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Mar 28</td>
<td>Animal Immune Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Mar 30</td>
<td>Animal Immune Response – Case Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Apr 1</td>
<td>EXAM 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Apr 4</td>
<td>Animal Osmoregulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Apr 6</td>
<td>Animal Osmoregulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Apr 8</td>
<td>Animal Osmoregulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Apr 11</td>
<td>Animal Endocrine System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Apr 13</td>
<td>Animal Endocrine System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Apr 15</td>
<td>Animal Endocrine System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Apr 18</td>
<td>Animal Reproduction &amp; Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Apr 20</td>
<td>Animal Reproduction &amp; Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F Apr 22</td>
<td>Wrap-up Animal Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M Apr 25</td>
<td>Last Day of Classes – Assignment Due</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T Apr 26</td>
<td>READING DAY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Apr 27</td>
<td>Final Exams Begin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday Apr 30</td>
<td>FINAL CUMULATIVE EXAM** (1:00-3:00pm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Exam dates are firm. However, topics covered on certain days are subject to change.

** Please note: as stated in the Undergraduate Catalog:

http://catalog.cofc.edu/content.php?catoid=14&navoid=671#final-examinations

“Examinations must be taken at the time scheduled (https://registrar.cofc.edu/pdf/exam-schedule-fall2020.pdf), except when:

1. Two or more exams are scheduled simultaneously.
2. Legitimate AND documentable extenuating circumstances prevent the student from completing the examination at the scheduled time (e.g., burial services for an immediate family member).”

**Learning Goals and Objectives**

*Learning Goals & Objectives* for Biology 111 and 111L Introduction to Cell and Molecular Biology/ BIOL 112 & 112L Evolution, Form, and Function of Organisms

Department: Biology

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
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.

- **Scientific Methods of Discovery**
  - 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 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 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

[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.*