Biology 112 Lab Common Syllabus

Lab Overview

This foundation course for biology majors provides an introduction to evolution and organismal biology. In this 2nd semester of the introductory lab sequence we will continue to develop scientific and critical thinking skills that form basis for the practice of science and use of scientific knowledge for understanding and evaluating contemporary topics in biology.

As in Biol 111L, we will continue to explore important biological concepts and processes, but do so in a way that will help you to more fully appreciate how scientists have come to understand them, and to help you to use/evaluate scientific knowledge to better understand science-related societal issues which confront humans in their personal, professional and civic lives. The lab curriculum is structured to give you more practice doing various aspects of science in the context of exploring evolutionary and organismal biology concepts, and culminates in a multi-week team project in which you will be engaged in the entire process of proposing, designing, conducting, writing, and presenting a scientific research project of your own design. In this way you will experience not only the power that science has to reveal the workings of the natural world, but also the dynamic nature of this knowledge.

During lab, you will be working in small teams on several experiments over the course of the semester. For most labs you will have individual responsibilities for preparing for the coming week’s laboratory. These involve homework assignments, textbook readings, outside research or tutorial review. Your individual preparation for lab will be essential for the success of the whole team. Your final grade in this lab course will be based on a combination of your grades on both individual and team assignments. Successful completion of Biol 111/111L (or 151 & 151L) & Biol 112/112L (or 152 & 152L) fulfills the general education natural science requirements at the College of Charleston.

↓ Team Grades – These are grades given to each member of the team and are based on work that all members of the team collaborated on. Team grades are given for the Team Lab Notebook (TLN) completed for each lab, along with other work done by the team during lab. Please be aware that the lab instructor can adjust these grades based on each person’s participation in the lab, and contribution to the team effort as reflected by peer evaluations which you will complete each week. Those who participated/contributed will receive the full worth of the team’s grade; those who did not contribute fully will only receive partial credit. The guidelines for completing the weekly peer evaluations are in the Student Forms Appendix in your lab manual. Look over this carefully so that you understand your responsibilities to your teammates for lab.

↓ Individual Points – These are grades given to each member of the team and are based on work that is to be done individually. Some of the labs require that each member of the team write the discussion (or conclusions) of the lab separately. Often there will be a quiz at the start of each lab. Quizzes will cover the previous lab, and reading/homework to be done in preparation for that day’s lab. There is also pre-lab homework to be completed prior to most labs. Table 1 lays out the percent each assignment category counts toward your final lab grade. Note that the grade categories are color coded and correspond with the schedule of assignments (Table 2).

<table>
<thead>
<tr>
<th>Grade Category</th>
<th>Percent of Final Grade</th>
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<tbody>
<tr>
<td>Team Lab Notebooks &amp; other team lab work (Team)</td>
<td>30%</td>
</tr>
<tr>
<td>Quizzes &amp; other individual work (Individual)</td>
<td>25%</td>
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<tr>
<td>Homework (Individual)</td>
<td>10%</td>
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<tr>
<td>Final Independent Project (Team &amp; Individual)</td>
<td>30%</td>
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<tr>
<td>*Attendance, Participation &amp; Progress (Individual)</td>
<td>5%</td>
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*This grade is subjective and based on your lab instructor’s assessment of your individual contribution to your team, prompt and regular attendance to lab, preparation for lab, and improvement over the course of the semester.
Table 2. Schedule of Assignments – all work is graded on a 100 point scale.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lab</th>
<th>Team Earned Points</th>
<th>Individually Earned Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>**Quizzes and other</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>individual work**</td>
</tr>
<tr>
<td>Jan 11</td>
<td>Lab 1 – Darwinian Snails</td>
<td>Lab 1 TLN</td>
<td>-</td>
</tr>
<tr>
<td>Jan 25</td>
<td>Lab 2 – Evolutionary Genetics – Sickle Anemia</td>
<td>Lab 2 TLN</td>
<td>Quiz over Lab 1 &amp; course syllabus</td>
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<tr>
<td>Feb 1</td>
<td>Lab 3 – Thermoregulation</td>
<td>Lab 3 TLN</td>
<td>Quiz over Lab 2</td>
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<tr>
<td>Feb 8</td>
<td>Lab 4 – Water Transport in Plants</td>
<td>Lab 4 TLN</td>
<td>- Lab 3 Conclusions - Quiz over Lab 3</td>
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<tr>
<td>Feb 15</td>
<td>Lab 5 – Animal Circulation Part 1</td>
<td>Lab 5 Week 1 TLN</td>
<td>- Lab 4 Conclusions - Quiz over Lab 3</td>
</tr>
<tr>
<td>Feb 22</td>
<td>Lab 5 – Animal Circulation Part 2</td>
<td>Lab 5 Week 2 TLN</td>
<td>- Quiz over Lab 5 Part 1</td>
</tr>
<tr>
<td>Feb 29</td>
<td>Lab 6 – Exploring a Scientific Article (Wk 1)</td>
<td>Lab 6 TLN</td>
<td>- Quiz over Lab 5 Part 2</td>
</tr>
<tr>
<td>Mar 14</td>
<td>Lab 6 - Student Projects (Wk 2): The Research Proposal</td>
<td>Team Proposal &amp; Proposal Peer Evaluation</td>
<td>-</td>
</tr>
<tr>
<td>Mar 21</td>
<td>Lab 6 - Wk 3: Data Collection</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mar 28</td>
<td>Lab 6 - Wk 4: Data Collection</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Apr 4</td>
<td>Lab 6 - Wk 5: Data Analysis &amp; Poster Preparation</td>
<td>-</td>
<td>- Extended Abstract due at start of lab (Note: Students who do not submit an ext. abstract must develop and present the poster on their own.)</td>
</tr>
<tr>
<td>Apr 11</td>
<td>Poster Symposium</td>
<td>Project Poster</td>
<td>- Peer Evaluation of another team’s posters</td>
</tr>
</tbody>
</table>

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

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

Lab Grade Determination – Your final grade in lab will be determined using the grade distribution.

- A 93-100%
- A- 90-92
- B+ 87-89
- B 83-86
- B- 80-82
- C+ 77-79
- C 73-76
- C- 70-72
- D+ 67-69
- D 63-67
- D- 60-62
- F Below 62

Lab Attendance is, of course, required! If you miss a lab for an excused reason (medical illness, family emergency, CoC athletics conflict), you must PROMPTLY arrange with your lab instructor to make up the lab in another lab section.

General guidelines for making up a missed lab:
In the event that you miss a lab with a legitimate, documentable reason, you may bring documentation to the Absence Memo Office (http://studentaffairs.cofc.edu/about/absence-memo/) located at 67 George Street (between Stern Center and Glebe Street). A representative from the Absence Memo Office will notify your lab instructor by email. Please note that undocumented absences will be considered unexcused.

- You should make every attempt to attend a lab section taught by your lab instructor during the same week.
- You may not attend another lab section without permission of your lab instructor.
- You will be working with another team in the makeup lab section you attend, but you should complete the Team Lab Notebook (TLN) on your own and turn it into your instructor so that you can receive a grade for the lab.
- Consult with your lab instructor for his or her makeup policy.

Unexcused absences will result in a 0 (zero) for that week’s lab. If you have more than one unexcused absence, you will be dropped from the lab. If you miss more than 2 labs, for any reason (excused or unexcused) you will be dropped from the lab. Be aware that the lecture and lab are co-requisites. If you are dropped from the lab due to non-attendance, or withdraw, you will also be dropped from the lecture. Any unexcused absence will have a significant impact on the attendance and participation part of your lab grade.

Honor Code and Academic Integrity

Plagiarism in this class — The structure of this class is probably going to be different from that of other science classes you have taken. In this class we will, to a large extent, be working in small teams, much like professionals do when they collaborate on projects. The collaborative work we do in this class is meant to encourage you to work together with your teammates to help each other learn. This will require that you share, justify and evaluate the ideas expressed among your teammates. So in short, you are allowed to work together on labs in this class. Working together means identifying knowledge your team needs to proceed, sharing research knowledge and resources, evaluating each other’s ideas about methods, analysis and conclusions & providing constructive feedback to your teammates. However, for some assignments you will be asked to work on them individually. When you write for these assignments, the ideas you express will of course be a collection of those constructed by your team and supported by background research, but what you write should ultimately be written individually, by you, and in your own words. Any information, concepts, ideas that you acquire from outside research sources must be summarized/explained in your own words, and appropriately cited (both in a work cited section and parenthetically in the body of the paper). In short, this class will be structured to allow you to work together to form your ideas, but you must ultimately express these ideas in your own words! In fact, I hope you come to realize that the act of expressing and justifying your ideas is learning!

Therefore the following constitutes what is and is not plagiarism in this class

<table>
<thead>
<tr>
<th>Plagiarism</th>
<th>NOT Plagiarism!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copying ideas constructed by another member of your team, from the class, or from other students who have taken this class in the past.</td>
<td>Summarize the ideas expressed by team or class members in your own words. Use these ideas to justify your solutions, conclusions or recommendations.</td>
</tr>
<tr>
<td>Copying (essentially word for word) the ideas (information, findings, analysis, and conclusions) expressed in a research resource (article, web site, textbook)</td>
<td>Summarize the thoughts expressed in the research resource in your own words. Use these ideas to justify your solutions, conclusions or recommendations and cite the source.</td>
</tr>
<tr>
<td>Summarizing information or ideas expressed in a research resource (i.e. a research article or web site) without citing the source. Without a citation, you are implying that the ideas are yours, when they are not!</td>
<td>Cite your research using APA citation style formatting both parenthetically, and in a Works Cited section at the end of the paper. Citing your sources is always required, unless otherwise specified in the assignment guidelines!</td>
</tr>
<tr>
<td>Using, in whole or in part, papers written for other classes to write an assignment for this class, without obtaining prior permission from the instructor.</td>
<td>If you have written a paper for another class which relates to a project we are working on, talk with your instructor about what you can and can’t use!</td>
</tr>
<tr>
<td>Quoting — Although not technically plagiarism, it is NOT acceptable in this class to present ideas, concepts, findings, as quoted text with a citation.</td>
<td>FIRST - explain information/ideas/concepts/findings that you get from research resources in your own words, and cite the source. Word for word quotes should ONLY be used in this class to support or drive home an idea that you have already constructed in your own words from research or your own findings.</td>
</tr>
</tbody>
</table>

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 clearly related more to a misunderstanding will 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 by both 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 XF 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 X to be expunged. 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 and/or test, no collaboration is permitted. Other forms of cheating include possessing or using an unauthorized study aid (such as a PDA), copying from others’ exams, fabricating data, and giving unauthorized assistance.

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
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**
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

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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.*
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