

Introduction to Cell & Molecular Biology Lab (BIOL111L)

Common Syllabus

This is a foundation course for biology majors provides an introduction to cell and molecular biology. In the first semester of this introductory lab sequence we will explore important biological concepts and processes, but do so in a way that will help you to develop the 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.

The lab curriculum is structured to gradually give you more practice doing various aspects of science, 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 lab preparation, participation, and contribution 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 1. Percent of final grade by grade category

Grade Category	Percent of Final Grade
Team Lab Notebooks & other team lab work (Team)	25%
Quizzes & other individual work (Individual)	30%
Homework (Individual)	10%
Final Independent Project Article (Individual)	25%
*Attendance, Participation & Progress (Individual)	10%

**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, effort, preparation for lab, and improvement over the course of the semester.*

Table 2. Schedule of Assignments, Quizzes and Readings

Week	Lab	Team Earned Points	Individually Earned Points		Readings & Tutorials
			Quizzes	¹ Homework	
Aug 31 Online	Lab 1 – Termite Trails	-	-	-	Post-lab reading: - Lab Manual Appendices B & C (pp. 137-150)
Sept 7	No Labs this Week			-Termite Trails rewrite (see lab manual pg. 4-5) – DUE TO the OAKS Dropbox by Friday, Sep. 11.	
Sept 14	Lab 2 – Osmosis & Diffusion: Part 1	TLN Lab 2 – Part 1	Quiz #1 over course syllabus & safety	-Pre-lab #2 Osmosis Lab Worksheet Questions (lab manual pg. 11)	Pre-lab Reading: - Textbook– Chapter 5
Sept 21	- Lab 2 – Osmosis & Diffusion: Part 2 - Lab 3 - Exploring Plant Metabolism	Lab #2 TLN – Part 2 Lab 3 TLN	Inferential Statistics Quiz #2	Inferential Statistics Summary Table (lab manual pg. 24); and Reaction Time Worksheet (pg. 25-26)	Pre-lab Readings - Lab manual Appendix D: Inferential Statistics - Textbook: Chapter 6.1, 6.4, 7.1, 8.1 - OAKS Tutorials: • Overview of Energetics & Cellular Respiration • Overview of Photosynthesis • Using a CO2 Sensor to Estimate Primary Productivity in Plants
Sept 28	Lab 4 (Week 1) – Exploring Metabolic Diversity: What Factors Effect Plant Productivity?	TLN Lab 4:Week 1 - Plant Metabolism Journal	-Quiz #3: Lab 3: Plant Metabolism	-Lab #2 Osmosis – Conclusions (see lab manual pg. 28-29) -Plant Metabolism Worksheet Questions (lab manual pg. 37-38)	Pre-Lab Tutorial: - Plant Metabolism & Productivity Tutorial on OAKS
Oct 5	- Lab 4 (Week 2) – Exploring Metabolic Diversity: The Research Proposal; - Lab 5 (Week 1): Exploring the Genetics of Eye Color in Fruit Flies	- TLN Lab 4:Week 2 - Team Proposal - Proposal Peer Evaluation	Quiz #4: Osmosis & Diffusion	-	Pre-lab Reading/Research: - Background biological research on the question you posed in Lab 4: Week 1. - Read Lab 5 Weeks 1-3: Exploring the Genetics of Fruit Fly Eye Color (pp. 65-71)
Oct 12	- Lab 4 (Week 3) – Exploring Metabolic Diversity: Data Collection - Lab 5 (Week 2): Genetics of Eye Color in Fruit Flies	TLN Lab 4:Week 3	-	-	
Oct 19	- Lab 4 (Week 4) – Exploring Metabolic Diversity: Continuing Data Collection & Analysis - Lab 5 (Week 3): Genetics of Eye Color in Fruit Flies	-	-	-	- Pre-lab Reading: • Guide to Scientific Writing (Lab Manual Appendix E) • Textbook Ch. 12 (pp. 313-322)
Oct 26	- Lab 6 - Lost in Timbuktu	Lost in Timbuktu TLN (Lab 6)	-	-	Pre-lab Readings: - Lost in Timbuktu: Read The Scenario and Complete the Pedigree Analysis (pg. 84-87). - Textbook Ch. 3.4-3.5; Ch 12 (pp. 323-325); Ch 17 (pp. 439-444). - - Lab 6 OAKS Tutorial: Gel Electrophoresis
Nov 2	- Lab 4 (Week 5) – Exploring Metabolic Diversity: Draft Article Peer Review - Lab 5 (Week 4): Genetics of Eye Color in Fruit Flies	-TLN Lab 4: Week 4 - Draft Article Peer Reviews & Scribe Summaries	Quiz #5 over Lab 6 (Lost in Timbuktu)	Independent Projects Draft Article Due to OAKS by Sunday Nov. 1	Pre-lab Reading: - Textbook Ch.6.5 - Lab 5: Week 4 & 5 (Lab Manual pg. 71-81)
Nov 9	Lab 5 – Genetics of Eye Color in Fruit Flies (Week 5) – <i>Drosophila</i> Genetics	Fly Genetics TLN (Lab 5)	-	-	Pre-lab Readings: - Textbook Ch 12 (pp. 325 -339)
Nov 16	Lab 7 – Genetics & Molecular Biology of Sickle Cell Anemia	Sickle Cell TLN (Lab 7)	- Quiz #6 over Lab 5 (Fruit Fly Genetics)	Pre-lab 7 Worksheet (lab manual pg. 103-104)	Pre-lab Reading: - Lab 7: Part 1 – Meeting the Affected Family (pg. 105-107) - Lab 7 OAKS Tutorial: Mutations - Textbook Ch. 15
Nov 23	Thanksgiving Break – No Labs this Week				
Nov 30 Online	Student Project Oral Presentations	- Oral Presentation	- Sickle Cell Letter (see lab manual pg. 119) – Due Dec. 7 - Project Presentation Peer Review	Final Independent Project Article	-

¹Homework is listed on the week it is due. Homework is due at the start of lab.

Quizzes will be over concepts from the previous week's lab, and homework reading for that day's lab. All work is graded on a 100 point scale.

Lab Grade Determination – BIOL 111L is a 1-credit course. The lab grade is separate from the 3-credit class grade. Letter grades in lab will be assigned according to the following percentages of total points earned.

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

Attendance is very important to your success in lab. If you miss a lab for an excused reason (medical illness, family emergency, CofC athletics conflict), you must arrange with your lab instructor to make up the lab in another lab section.

As a College of Charleston student, you are expected to do your best to ensure the health and safety of yourself, your peers, and the College of Charleston faculty and staff. We strongly urge all students to take the [COVID-19 Cougar Pledge](#). If you have, or suspect that you have contracted COVID-19, you should self-isolate and/or quarantine as per the College of Charleston guidelines.

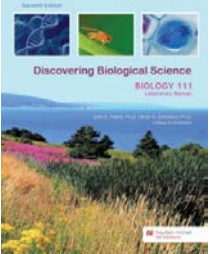

General guidelines for making up a missed lab:

- In the event that you must miss a lab for a legitimate reason, you must do everything possible to contact your instructor in advance of your lab meeting, preferably at least 24 hours in advance, so that special accommodations can be made in arrangement with your lab instructor. These accommodations may include one of the following:
 - Attending another lab section if space allows
 - Attending and participating in your scheduled lab section virtually if you feel well enough to do so.
 - When possible, completing the lab individually at another scheduled time and/or at home.
- You may not attend (virtually or in person) another lab section without explicit permission of your lab instructor!
- If you attend another lab section, you are responsible for submitting the Team Lab Notebook (TLN) and/or any other assignments to the respective OAKS assignment dropboxes for your regularly scheduled lab section for grading.
- Consult your lab section's syllabus for further information on makeup policies specific to your lab section.

During the COVID-19 pandemic you are not required to provide documentation justifying that an absence meets the criteria for being excused; however you are expected to abide by the [College of Charleston Honor Code](#) with regard to reporting an absence as a legitimate excused absence. You should also be aware of the significant consequences for lying about such matters. Absences that you admit to being unexcused will result in a 0 (zero) for that week's lab assignments. However in such cases, it will still be worthwhile to contact your lab instructor to find out what post-lab assignments you can complete and what you can do to be prepared for the following week's lab.

If you have more than one unexcused absence, you must either withdraw from lab or you will receive a failing grade (F). Note that if you choose to withdraw from the lab, you must also withdraw from the lecture class since the lab and class are co-requisites. Finally, if you are forced to completely miss three or more labs for health-related reasons, you should contact your lab instructor as soon as possible. In such cases it may be possible to withdraw from the lab, without having to withdraw from the lecture class, and to discuss arrangements for re-taking the lab in a subsequent semester.

Required Textbooks

	<p>Discovering Biological Science: Laboratory Manual for Biology 111 7th Ed., by John S. Peters and Brian G. Scholtens, Hayden-McNeil.</p> <p>Since labs will begin online, it is preferable that you purchase a digital manual through the College bookstore. Alternatively, if you prefer a bound hard copy, it can be purchased at the College Bookstore and shipped to your home prior to the start of the term. However, supplies of bound copies are limited. Do not purchase used manuals or older editions of the manual.</p>
	<p>OpenStax: Biology, 2nd Edition. This is an Open Access Textbook. There are several FREE options to view the text (online, pdf, Kindle, OpenStax App) or you can order a print copy (~\$40-\$50) from Amazon or the College Bookstore.</p>

Disability Services

The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the [Center for Disability Services/SNAP](#) located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying your lab instructor as soon as possible and no later than one week before accommodation is needed.

Use of the OAKS course management system

OAKS, including Gradebook, will be used for this course throughout the semester to provide the syllabus and class materials and grades for each assignment, which will be regularly posted.

Recording of Classes (via ZOOM)

At the discretion of your lab instructor, online labs may be recorded via both voice and video recording. By attending and remaining in this lab, you (the student) consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class.

Mental & Physical Wellbeing

At the college, we take every students' mental and physical wellbeing seriously. If you find yourself experiencing physical illnesses, please reach out to student health services (843.953.5520). And if you find yourself experiencing any mental health challenges (for example, anxiety, depression, stressful life events, sleep deprivation, and/or loneliness/homesickness) please consider contacting either the Counseling Center (professional counselors at <http://counseling.cofc.edu> or 843.953.5640 3rd Robert Scott Small Building) or the Students 4 Support (certified volunteers through texting "4support" to 839863, visit <http://counseling.cofc.edu/cct/index.php>, or meet with them in person 3rd Floor Stern Center). These services are there for you to help you cope with difficulties you may be experiencing and to maintain optimal physical and mental health. Information on how to maintain your health and wellness during the COVID-19 pandemic can be found at <https://cofc.edu/back-on-the-bricks/health-and-wellness/index.php>.

Food & Housing Resources

Many CofC students report experiencing food and housing insecurity. If you are facing challenges in securing food (such as not being able to afford groceries or get sufficient food to eat every day) and housing (such as lacking a safe and stable place to live), please contact the Dean of Students for support (<http://studentaffairs.cofc.edu/about/salt.php>). Also, you can go to <http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php> to learn about food and housing assistance that is available to you. In addition, there are several resources on and off campus to help. You can visit the Cougar Pantry in the Stern Center (2nd

floor), a student-run food pantry that provides dry-goods and hygiene products at no charge to any student in need. Please also consider reaching out to one of your Professors if you are comfortable in doing so.

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

Plagiarism	Proper use of sources
Copying ideas constructed by another member of your team, from the class, or from other students who have taken this class in the past.	Summarize the ideas expressed by team or class members in your own words. Use these ideas to justify your solutions, conclusions or recommendations.
Copying (essentially word for word) the ideas (information, findings, analysis, and conclusions) expressed in a research resource (article, web site, textbook)	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.
Summarizing information or ideas expressed in a research resource (i.e. a research article or web site) without citing the source. <u>Without a citation, you are implying that the ideas are yours, when they are not!</u>	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 <u>always</u> required, unless otherwise specified in the assignment guidelines!
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.	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!
Quoting – Although not technically plagiarism, it is unacceptable in this class to begin by presenting ideas, concepts, findings, as quoted text, even if you provide a citation.	Instead, FIRST explain, summarize or paraphrase information/ideas/concepts/findings that you get from research resources <u>in your own words</u> , and cite the source. ONLY use word for word quotes to support or drive home an idea or argument that you have already presented in your own words from research or your own findings.

Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when suspected, 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 misunderstanding and confusion will be handled by the instructor. The instructor designs an intervention or assigns a grade reduction to help prevent the student from repeating the error. The response is recorded on a form and signed both by the instructor and the student. It is forwarded to the Office of 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 status indicator 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.

Students can find the complete Honor Code and all related processes in the Student Handbook at:

<http://deanofstudents.cofc.edu/honor-system/studenthandbook/>

Introduction to Cell and Molecular Biology/Evolution, Form, and Function of Organisms

BIOL 111 & 111L/BIOL 112 & 112L

Department: Biology

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**

- ¹Understand 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 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 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

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