



NEW JERSEY CENTER
FOR TEACHING & LEARNING

Progressive Science Initiative® (PSI®)
BIOL6841: Learning and Teaching Honors Biology: Chemistry of Life

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Course Credit: 3.0 NJCTL credits

Dates & Times:

This is a 3-credit, self-paced course, covering 9 modules of content. The exact number of hours that you can expect to spend on each module will vary based upon the module coursework, as well as your study style and preferences. You should plan to spend approximately 15 hours per credit working online, and up to 30 hours per credit working offline.

Graduate Student Handbook: www.njctl.org/graduate-handbook/

COURSE DESCRIPTION:

This is the first in a three-course series which, together, are designed for those who are learning to teach high school biology. This is a rigorous chemistry course that builds upon foundational topics in physics and chemistry, pulling them together to represent a capstone of science education. Topics include chemistry and chemical bonds, energy and entropy, origins of life, chemistry of life, membranes, and enzymes.

STUDENT LEARNING OUTCOMES:

Upon completion of the course, the student will be able to:

1. Demonstrate an understanding of the chemistry related to biological structures and processes, detailed in the module learning outcomes below.
2. Integrate PSI materials (including presentations, labs, practice problems, etc.) to support student learning and deliver effective instruction.

3. Create a social constructivist learning environment through the use of formative assessment questions, interpreting the results of this assessment to effectively facilitate student-led discussions that support deeper understanding of the content.
4. Integrate multiple attempts to demonstrate student mastery of content knowledge, as encouraged/fostered by the PSI pedagogy.
5. Implement learning plans that are aligned to NGSS standards and allow for differentiation based on the needs of learners.

TEXTS, READINGS, INSTRUCTIONAL RESOURCES:

Required Texts:

PSI Biology uses a free digital textbook accessible at: <https://njctl.org/materials/courses/biology-3/>

COURSE REQUIREMENTS:

In order to receive a Passing grade, the participant must complete the following course requirements:

1. **Activities:** A number of different learning activities will ensure participant engagement and learning in the course. These include:
 - Engage in video module lessons which demonstrate minimized direct instruction followed by frequent formative assessment.
 - Completion of formative assessments aligned to learning objectives which include detailed analysis when answered incorrectly.
 - Interaction with module discussion boards that allow conversation with peers and course instructors about the module's content, delivering that content to students. Discussion boards also serve as a place to ask and answer questions related to the module's content.
2. **Short Answer Assignment:** Each module requires one (1) original response to a given prompt. These prompts are typically based upon course lessons and require teachers to analyze, reflect, and make connections between the module's content and their own classroom practice.
3. **Mastery Exercises:** For each module, these multiple-choice question quizzes assess the content knowledge gained in a module. Participants have the opportunity to retake; random questions are pulled from a larger question bank on each attempt ensuring varied questions.
4. **Virtual Labs:** In each module, a virtual lab write-up will be submitted. Virtual Labs are interactive lab simulations that promote a deeper understanding of the content knowledge being learned through real-world applications and analysis.
5. **Module Exam:** One is completed at the end of each module. It is a culminating exam consisting of multiple choice and free response questions aligned to the standards and objectives of the module.
6. **Reflection Paper:** At the end of the course, participants are required to reflect on the knowledge taught in the course, make connections, and compare/contrast their current pedagogy with new strategies gained in this assignment.
7. **Final Exam:** At the end of the course, a comprehensive exam consisting of Multiple Choice and Free Response questions assesses the content knowledge learned throughout the course.

GRADE DISTRIBUTION AND SCALE:

Grade Distribution:

Module Exams	70%
Final Exam	10%
Labs	6%
Short Answer Assignments	6%
Mastery Exercises	6%
Reflection Paper	2%

Grade Scale:

A	93 – 100
A-	90 – 92
B+	86 – 89
B	83 – 86
B-	80 – 82
C+	77 – 79
C	73 – 76
C-	70 – 72
D	60.0 – 69.9
F	59.9 or below

GRADING RUBRIC:

The following rubric is used to score:

- Short Answer Assignment – 6% of grade
- Reflection Paper – 2% of grade

The minimum possible score for this rubric is 4 points, and the score will be converted to the minimum grade available in this module (which is zero unless the scale is used). The maximum score of 25 points will be converted to the maximum grade.

Intermediate scores will be converted respectively and rounded to the nearest available grade. If a scale is used instead of a grade, the score will be converted to the scale elements as if they were consecutive integers.

	Meets Expectation	Approaches Expectation	Below Expectation	Limited Evidence
	<i>7 points</i>	<i>5 points</i>	<i>3 points</i>	<i>1 point</i>
Content	<ul style="list-style-type: none"> • Demonstrates excellent knowledge of concepts, skills, and theories relevant to topic. 	<ul style="list-style-type: none"> • Demonstrates fair knowledge of concepts, skills, and theories. 	<ul style="list-style-type: none"> • Demonstrates incomplete or insubstantial knowledge of concepts, skills, and theories. 	<ul style="list-style-type: none"> • Demonstrates little or no knowledge of concepts, skills, and theories.
Depth of Reflection	<ul style="list-style-type: none"> • Content is well supported and addresses all required components of the assignment. 	<ul style="list-style-type: none"> • Content is partially supported; addresses most of the required components of the assignment. 	<ul style="list-style-type: none"> • Content contains major deficiencies; addresses some of the required components of the assignment. 	<ul style="list-style-type: none"> • Content is not supported and/or includes few of the required components of the assignment.
Evidence and Practice	<ul style="list-style-type: none"> • Response shows strong evidence of synthesis of ideas presented and insights gained throughout the entire course. The implications of these insights for the respondent's overall teaching practice are thoroughly detailed, as applicable. 	<ul style="list-style-type: none"> • Writing is mostly clear, concise, and well organized with good sentence/paragraph construction. Thoughts are expressed in a coherent and logical manner. There are no more than five spelling, grammar, or syntax errors per page of writing. 	<ul style="list-style-type: none"> • Response is missing some components and/or does not fully meet the requirements indicated in the instructions. Some questions or parts of the assignment are not addressed. Some attachments and additional documents, if required, are missing or unsuitable for the purpose of the assignment. 	<ul style="list-style-type: none"> • Response excludes essential components and/or does not address the requirements indicated in the instructions. Many parts of the assignment are addressed minimally, inadequately, and/or not at all.
	<i>4 points</i>	<i>3 points</i>	<i>2 points</i>	<i>1 point</i>
Writing Quality	<ul style="list-style-type: none"> • Writing is well-organized, clear, concise, and focused; no errors. 	<ul style="list-style-type: none"> • Some minor errors or omissions in writing organization, focus, and clarity. 	<ul style="list-style-type: none"> • Some significant errors or omissions in writing organization, focus, and clarity. 	<ul style="list-style-type: none"> • Numerous errors in writing organization, focus, and/or clarity.

The following rubric is used to score:

- Labs – 6% of grade

The minimum possible score for this rubric is 2 points, and the score will be converted to the minimum grade available in this module (which is zero unless the scale is used). The maximum score of 14 points will be converted to the maximum grade.

Intermediate scores will be converted respectively and rounded to the nearest available grade. If a scale is used instead of a grade, the score will be converted to the scale elements as if they were consecutive integers.

	Meets Expectation	Approaches Expectation	Below Expectation	Limited Evidence
	<i>7 points</i>	<i>5 points</i>	<i>3 points</i>	<i>1 point</i>
Completeness	<ul style="list-style-type: none"> • Lab write-up is complete with no missing fields. 	<ul style="list-style-type: none"> • Lab write-up has 1-2 missing fields. 	<ul style="list-style-type: none"> • Lab write-up has 3-5 missing fields. 	<ul style="list-style-type: none"> • There are more than 5 missing fields on the lab write-up.
Calculations	<ul style="list-style-type: none"> • All answers are calculated correctly. 	<ul style="list-style-type: none"> • Most answers are calculated correctly, but there are 1-2 minor calculation errors. 	<ul style="list-style-type: none"> • Most answers are calculated correctly, but there are multiple minor calculation errors, or 1-2 gross miscalculations. 	<ul style="list-style-type: none"> • There are calculation errors throughout the lab.

The remaining types of assignments are not scored using a rubric. These assignments are scored using percentage correct to assign a letter grade. The assignments in this manner are as follows:

- Mastery Exercises – 6% of grade
- Module Exams – 70% of grade
- Final Exam – 10% of grade

Mastery Exercises can be retaken as many times as desired to ensure a high score. Due to the nature of these assignments, each time they are taken, they will be composed of ten unique questions pulled randomly from a larger question bank.

Module and Final Exams are scored using a curve, which allows us to keep content exams rigorous. Module Exams can be retaken one time. Final Exams cannot be retaken.

ACADEMIC STANDING:

NJCTL has established standards for academic good standing within a student's academic program. Students enrolled in any NJCTL online course must receive an 80 or higher to successfully complete a course and receive credit for that course. An 80 is equivalent to a GPA of 2.7 or B-. Additionally,

students in an endorsement program must receive a cumulative GPA of 3.0 for all courses combined in order to successfully complete the program.

ACADEMIC INTEGRITY:

Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /repurposing your own work, unauthorized possession of academic materials, and unauthorized collaboration.

CITING SOURCES WITH APA STYLE:

All students are expected to follow proper writing and APA requirements when citing in APA (based on the APA Style Manual, 6th edition) for all assignments.

DISABILITY SERVICES STATEMENT:

We are committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Dean of Students, Melissa Axelsson, for additional information to coordinate reasonable accommodations for students with documented disabilities (melissa@njctl.org).

NETIQUETTE:

Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom.

If you have concerns about something that has been said, please let your instructor know.

CLASS SCHEDULE:

Module	Module Learning Outcomes	Assignments
1 – Chemistry & Chemical Bonds	<ul style="list-style-type: none">• Determine if a chemical reaction has occurred by analyzing data on the properties of substances before and after they interact.• Develop a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.• Develop a model to show that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in a system.• Construct an evidence-based scientific explanation illustrating the photosynthesis in the cycling of matter and flow of energy into and out of the organisms.	<ul style="list-style-type: none">• Short Answer Assignment• Lab• Mastery Exercise

<p>2 – Energy & Entropy</p>	<ul style="list-style-type: none"> ● Determine if a chemical reaction has occurred by analyzing data on the properties of substances before and after they interact. ● Develop a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. ● Develop a model to show that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. ● Construct an evidence-based scientific explanation illustrating the role of photosynthesis in the cycling of matter and flow of energy into and out of the organisms. 	<ul style="list-style-type: none"> ● Short Answer Assignment ● Lab ● Mastery Exercise ● Module Exam
<p>3 – Origins of Life</p>	<ul style="list-style-type: none"> ● Explain the formation of Earth’s naturally occurring elements. ● Describe two theories regarding the origin of life on Earth. ● Identify an object as living or nonliving. ● Graph the evolution of living organisms on Earth. 	<ul style="list-style-type: none"> ● Short Answer Assignment ● Lab ● Mastery Exercise ● Module Exam
<p>4 – Chemistry of Life</p>	<ul style="list-style-type: none"> ● Describe the importance of carbon in day to day functions of a living organism. ● Identify the 4 main macromolecules by examining their structures. ● Determine whether an unknown lipid is saturated or unsaturated. ● Using different indicators, determine what organic compound is present in a solution. 	<ul style="list-style-type: none"> ● Short Answer Assignment ● Lab ● Mastery Exercise ● Module Exam
<p>5 – Membranes</p>	<ul style="list-style-type: none"> ● List the reasons a semi-permeable membrane in the cell is essential to cell functions. ● Use dialysis tubes to describe hypotonic and hypertonic solutions. ● Describe the different methods of membrane transport, and which methods require an input energy, and which methods do not require an input of energy. ● Calculate the concentration of solutions and compare the internal and external concentrations. 	<ul style="list-style-type: none"> ● Short Answer Assignment ● Lab ● Mastery Exercise ● Module Exam
<p>6 – Enzymes</p>	<ul style="list-style-type: none"> ● Describe the catalytic cycle of an enzyme. ● Use graphs to determine the optimal environmental conditions of an enzyme. 	<ul style="list-style-type: none"> ● Short Answer Assignment ● Lab ● Mastery Exercise ● Module Exam
<p>7 - Plant Biology</p>	<ul style="list-style-type: none"> ● Explain the characteristics of vascular and non -vascular plants. ● State the structure and function of leaves, roots and stems. ● Understand types of plant reproduction. 	<ul style="list-style-type: none"> ● Lab ● Mastery Exercise ● Module Exam

8 - Soil & Soil Pollution	<ul style="list-style-type: none"> ● Describe the components and characteristics of different types of soil. ● Discuss common soil pollutants and their effects. ● Discuss how to clean up and control soil pollution. 	<ul style="list-style-type: none"> ● Lab ● Mastery Exercise ● Module Exam
9 - Reflection	<ul style="list-style-type: none"> ● Review topics as desired ● Zoom meeting with instructor to review prior to final exam, as needed ● Discussion Board 	<ul style="list-style-type: none"> ● Reflection Paper ● Module Exam