Biology 2010: Cell Biology and Biochemistry, Fall 2021
Section 1 (3 units lecture + 1 unit lab)

Instructor: Dr. Mike Dorrell (Phone: 619-849-2962 (ext. 2962), E-mail: mdorrell@pointloma.edu)

Time and place: Monday/Wednesday/Friday, 1:30 pm – 2:35 pm (alternate Fridays)
Ryan Learning Center, room 108

Text: Brooker et al., **Principles of Biology (3rd edition)**.

3 options for purchase: (All Can be ordered through the bookstore or online).

1) Biology and Biology-Chemistry majors will need the text for 3 semester courses and Connect access for 1 semester. 1 semester Connect begins when you activate code online. Hard-bound or loose leaf printed version of the text with a 1 semester Connect code: ***ISBN = 9781307005332*** (hard bound text) or ***ISBN = 9781307005356*** (Loose leaf).
2) Applied health, diatetics, chemistry, or other majors who only need 1 semester of biology. 1 semester Connect access with Etext: ***ISBN = 9781307005448*** ($87)

Note that even if you obtain the text from a separate source, you will still need to purchase the 1 semester Connect access for this course.

Lab manual: The lab manual is available as a course reader from University Readers. **You must order and have your own reader** (~$25)

Office hours: Office Hours (most days): M,W,F 8:30 – 11:30; M, F 3 – 5 PM.
I have an open door policy and I am here for you! Feel free to set up a time or drop by.

Learning objectives: ***The overarching goal of this course is to prepare students for subsequent in-depth coursework in Biology, Biology-Chemistry, and health sciences.***

Specific learning outcomes; Students will be able to:

1) Understand basic principles of the inner function of cells, including how cells obtain and use energy through cellular respiration and/or photosynthesis, how membranes regulate cellular composition, how cells organize and communicate within a multicellular organism, and how genetic material is copied and converted to phenotypic information. (Program learning outcome #1)
2) Apply content to various scenarios in order to describe how a cell would react under changing environmental conditions, and relate problems associated with malfunctions in various important cellular processes. (Program learning outcome #1)
3) Evaluate current bioethical issues from an understanding of science and our moral responsibilities as Christians. (Program Learning Outcome #3)
4) Utilize skills and techniques critical to experimentation in a cell and molecular biology laboratory setting. (Program learning outcome #1)
5) Design scientific experiments with appropriate controls and analyze scientific data, demonstrating knowledge of the purpose, experimental method, data, and basic statistical interpretation. (Program learning outcome #1)
6) Demonstrate critical thinking skills related to scientific methods, data analysis, and conclusions. (GELO 1d; *Select questions on the final exam will be used to assess GELO 1d. Critical Thinking: Students will be able to examine, critique, and synthesize information in order to arrive at reasoned conclusions).*

PLNU Mission: To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Description:

An introduction to the principles of cell biology, molecular biology, and biochemistry. Topics include the chemical basis of life, basic membrane functions and membrane transport, basic metabolic pathways including cellular respiration and photosynthesis, cell division, and expression of the genetic material. Lecture and lab.

Specific content covered:

1) Scientific method (Chapter 1 and laboratory work)
2) Basic chemistry of molecular bonding and interactions. (Chapter 2)
    - electronegativity, bond polarity, hydrophobic and hydrophilic properties
    - covalent, hydrogen, ionic, and disulfide bonds, and Van der Waals interactions
3) Biological properties of cellular macromolecules (Chapter 3)
    - chemistry of lipids, carbohydrates, proteins, and nucleic acids
    - dehydration reactions / monomer polymerization
    - protein folding and side chain interactions
4) Systems biology (Chapter 4, chapter 12)
    - cellular organization / organelle purposes and function
    - protein synthesis and targeting pathways (endomembrane system)
5) Cell membranes, cellular compartmentalization, and membrane transport (Chapter 5)
    - selective permeability for diffusion of components across the membrane
    - cellular gradients, membrane proteins, and membrane transport
6) Cellular respiration and photosynthesis (Chapters 6 – 7)
    - properties and functions of enzymes, thermodynamics and energy of activation
    - glycolysis, Citric Acid cycle, and oxidative phosphorylation
    - aerobic and anaerobic respiration
    - Light reactions (cyclic and linear photosynthesis) and the Calvin Cycle
7) Cell communication and cell signaling (chapter 8)
    - ligand – receptor binding and the concept of threshold
    - intracellular signaling cascades and signal amplification.
8) DNA structure and replication (chapter 9)
    - bi-directional replication, Okazaki fragments
    - roles of various enzymes during replication
9) Gene expression (Protein synthesis); (Chapter 10)
    - transcription, RNA processing, and translation
    - introduction to mutations
10) Mitosis and meiosis (Chapter 14)
    - stages of mitosis and meiosis, and chromosomal movements during each
    - normal cell cycle controls
11) Introduction to genetics (Chapter 15)
    - Mendelian and non-Mendelian genetics
    - Principles of inheritance

Evaluation and grading:

Point breakdown (tentative; may be altered slightly)	
3 midterm exams	38%
1 final exam	17%
LearnSmart assignments and other homework	15%
peer teaching assignments / Team Activities / participation	7%
Laboratory grade	23%
TOTAL	100%

Exams – While Bio2010 can be taken as a GE course or to meet requirements for the allied health sciences, it is most commonly the first Biology course for students with declared majors in Biology or Biology-Chemistry. The content and concepts introduced in this course are foundational to virtually all subsequent courses in the program, thus it is essential that you maximize retention of the content and concepts beyond the exams.

There will 3 midterms (~100 pts each) and a final exam (~160 pts). Each exam will consist of multiple choice and short answer questions and/or calculation problems. All of science is cumulative such that scientific knowledge must build and expand upon previous knowledge. The same is true when learning science, you must remember and apply all that you have previously learned in order to completely understand and apply newer material. Thus, although the focus of each midterm will be on recent material, each should be thought of as a cumulative exam.

If you have a conflict with an exam date/time, you must let the instructor know well in advance. Makeup exams will be at the discretion of the instructor.

The final exam must be taken at the scheduled place and time.

Homework: -- Homework, including the LearnSmart assignments, will be assigned periodically throughout the semester. Late work will lose 20% per late class up to 1 week late (3 classes) at which point a 0 will be given.

***Learnsmart assignments* 10 x ~10 - 15 pts each** – Your textbook comes with excellent, individualized learning tools to help you master the material.
To hold students accountable for the assigned reading, LearnSmart assignments are on assigned reading that we have not yet covered in class. Having already been introduced to key terms and concepts, we will be ready to work together and focus on concepts and application of knowledge in class. There are also optional practice work through LearnSmart that I have designed to provide additional opportunities to practice applying key concepts. These mirror concepts and higher order learning assessment that you will see in exams.

Peer teaching – Teaching is a great way to learn. On some days, for 10 - 15 minutes at the beginning of class, we will break into peer groups, where one student in the group will teach the others a particular topic, usually describing a key historical experiment that has allowed us to understand current biology related to our course. Topics are listed in the tentative course schedule. **The teaching student will be required to turn in a study guide/outline of the topic (also to be provided to each group member).** Points are awarded according to the degree of preparedness, student evaluations, and the quality of the study guide / outline. **You are allowed to swap weeks with another student in your group, assuming you both agree, but you must inform me of the swap ahead of time.**

Team Activities / quizzing: On some Fridays, we will do Team Activities to practice higher level learning and application. The topic is listed in the schedule. Each student is responsible for reading and preparing any background materials in advance. There may be a short, individual quiz taken on the material prior to the activity to ensure that students are completing the required background work.

Laboratory experience – An essential part of any science curriculum is hands-on experience in the lab. The Bio210 lab is designed to expose the student to some of the essential tools of the scientist in a safe, controlled environment. Please see the separate lab syllabus for details. ***Lab does not meet during the first week of classes.***
***Lab reports will be taught and assessed as part of GELO1a, 1d, and 1e)*

Class participation - Class attendance and participation will be based on iClicker participation, attitude, and preparation / contribution in peer teaching and group work. I require **iclickers** and have questions throughout the course that are answered by iclicker. **Generally I am looking for thought and participation, not whether or not you answered the question correctly**. **Everyone must have their own Iclicker and it must be registered with your student ID number.** Bring your iClicker to class each day. Available in the bookstore or online: http://www.iclicker.com/Products/iclicker2/

Approximate grade breakdown

			93-100%	=	A	90-93%	=	A-
87-90%	=	B+	83-87%	=	B	80-83%	=	B-
77-80%	=	C+	73-77%	=	C	70-73%	=	C-
67-70%	=	D+	63-67%	=	D	60-63%	=	D-
≤ 59%	=	F						

A minimum grade of C in this course is required to advance to Genetics. (A grade of C$^-$ (C minus) or lower is not acceptable for advancement to Genetics.)

First-semester Freshmen earning an F will be offered the opportunity to retake a course once, with the new grade completely replacing the F.

Respect for one another and for the instructor is essential for an effective classroom environment. You are expected to show respect to your classmates and instructors by:

- listening when others are speaking,
- refraining from discussing non-related issues during class,
- Respecting the opinions of others, even when you disagree.

Behavior intended to embarrass or ridicule others will not be tolerated.

Tips for reading a textbook:

- Keep the big picture in mind. Before reading, look at chapter organization. Read the subheadings and get a feel for the breadth and arrangement of topics covered.
- Go over the figures and special topics sections very closely. Be sure you can explain the "take-home message" and main ideas of each. These are critical to understanding biology and should not be considered "pages to skip".
- Highlight words, phrases, and statements you know you will want to find again.
- Write comments to yourself that will help you study the material later.
- When you've finished a chapter, sometime before the exam, create a study guide that outlines the contents. This can then serve as a checklist for future studying.
- Your book has online materials that are very useful to help you learn; animations, videos, practice tests and quizzes, etc. Use these online resources.

PLNU COPYRIGHT POLICY

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU ACADEMIC HONESTY POLICY

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

PLNU ACADEMIC ACCOMMODATIONS POLICY

While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

PLNU ATTENDANCE AND PARTICIPATION POLICY

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See Academic Policies in the Undergraduate Academic Catalog.

Dorrell Fall Schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
7:30		At The Lowy Medical Research Institue for research (CAN BE REACHED BY EMAIL OR PHONE (858-249-7108) FOR EMERGENCIES)		Bio3050: Advanced Cell Biology lab	
8:00					
8:30					
9:00					
9:45	Chapel 9:45 - 10:30		Chapel 9:45 - 10:30		Chapel 9:45 - 10:30
10:00					
10:30	**Office hours**		**Office hours**		
11:00					
11:30			**Faculty lunch**		
12:00	Bio3050 Advanced Cell		Bio3050 Advanced Cell		Bio3050 Advanced Cell
12:30					
1:00					
1:30	Bio2010 Cell Biology and Biochemistry		Bio2010 Cell Bio and Biochem	**Bio2010 Lab, section 1b**	Bio2010 Cell Bio and Biochem
2:00					
2:30					
3:00	**Office hours /committee meetings (email me to inquire about my availability)**		**Bio2010L Cell Biology and Biochemistry lab (section 1a)**		
3:30					
4:00					
4:30					
5:00					
5:30					
6:00					

TENTATIVE COURSE SCHEDULE

Week	Date	Topic	Textbook Reference
Week 1	**8-31 (Tues)**	Syllabus and introduction (part on canvas – videos)	
	9-1	Biology as a Scientific Discipline: Hypotheses vs. predictions; Independent and Dependent variables	Chapter 1, pages 1 -5 and 12 - 17
	9-3	Biology as a Scientific Discipline: Statistics	
	Friday peer teaching and Team Activity: Introduction and Instructions		
Week 2	**9-6**	**Day off; Labor Day**	
	Chemical Basis of Life – EdPuzzle activity …. And LearnSmart Chapter 2 due by noon on Wednesday, 9-8		
	9-8	Chemical Basis of Life (electro-negativity, hydrophobic/ hydrophilic)	2.1 – 2.4 (pages 18 - 31)
	9-10	Organic Molecules I (Carbon-based chemistry	2.3 – 2.4 (pages 27 - 31
Week 3	**LearnSmart Chapter 3 due by noon on Monday, 9-13**		
	9-13	Organic Molecules II (lipids / nucleic acids)	3.1 - 3.5, 3.7
	9-15	Organic Molecules II (proteins)	3.6 (45 - 52)
	9-17	Organic Molecules III Catch-up	4.2 – 4.3 (56 - 72)
	Peer teaching (peers #1): Feature Investigation 3.15 (Pgs 51 – 53) + additional questions and considerations found within the assignment on canvas Team Activity #1: Review of Chapter 2 and Chapter 3 concepts (quiz at beginning)		
Week 4	**Organelles matrix …. And LearnSmart Chapter 4 due by noon on Monday, 9-20**		
	9-20	Cell Structure overview (genomes and proteomes, organelles, etc.)	4.2 – 4.3 (56 - 72)
	9-22	Cell Organization (protein transport, extracellular matrix, and cell concepts)	4.3 – 4.8
	9-24	Friday off (for extra 10 minutes of class each day); optional review session.	
Week 5	**Membrane fluidity EdPuzzle activity … and LearnSmart Chapter 5 due by noon on Wednesday (9-29)**		
	9-27	**Exam 1**	**Covers Ch. 1 - 4**
	9-29	Cell Membranes I (membrane structure and membrane proteins)	5.1 – 5.2 (95 - 100)
	10-1	Cell Membranes II (membrane transport)	5.3 – 5.4 (100 - 109)
	Team Activity #2: Review of Exam 1		
Week 6	**EdPuzzle on Thermodynamics… and LearnSmart Ch. 6 – part 1 (6.1 – 6.3); (due Monday, 10-4, by noon)**		
	10-4	Thermodynamics, endergonic vs. exergonic rxns	6.1 (117 - 120)
	10-6	Enzymes	6.2 (121 – 125)
	10-8	Friday off (for having class an extra 10 minutes each day)	

Week	Date	Topic	Textbook Reference
Week 7	**LearnSmart Chapter 6- Part 2 (6.4 – 6.9; Connect) due Monday, 10-11, by noon**		
	10-11	Cell Respiration I (glycolysis / Citric acid cycle)	6.3 – 6.6 (125 – 135) don't memorize pathways)
	10-13	Cell Respiration II (OP, fermentation)	6.7 (135 - 142 + sup.)
	10-15	Photosynthesis I (photosystems 1 & 2)	7.1 – 7.3 (143 - 153)
	Peer teaching (peers #2); Feature Investigation 6.21 (pages 143 – 145) + additional questions and considerations found within the assignment on canvas Team Activity #3: Cell respiration and photosynthesis		
Week 8	**LearnSmart Chapter 7 due by noon on Monday, 10-28**		
	10-18	Photosynthesis II (Calvin cycle)	7.4- 7.5 (153 - 161)
	10-20	**Exam II.**	**Through chapter 7**
	10-22	**NO CLASS: Fall Break**	
Week 9	**EdPuzzle activity; Threshold…LearnSmart Chapter 8 due by noon on Monday, 10-25**		
	10-25	Cell Communication I (threshold and ligand receptor interactions)	Introduction & 8.1 – 8.2 (162 - 167)
	10-27	Cell Communication II (types of cell signaling / signal cascades / response)	8.3 – 8.6 (168 - 177)
	10 -29	Cell Communication III (catch-up)	
	Team Activity #4: Experiments that Identified DNA as the Genetic Material		
Week 10	**LearnSmart Chapter 9 due by noon on Monday, 11-1**		
	11-1	Nucleic Acid Structure/Replication I	9. 1 – 9.4 (183 - 191)
	11-3	Nucleic Acid Structure/Replication II	9.5 (191 - 196)
	11-5	Fifth Friday off	
Week 11	**11-8**	Nucleic Acid Structure/Replication III	9.5 (cont.), 11.2 (telomerase)
	11-10	Catch-up / In-class activity on Molecular Biology	In-class groups and homework
	11-12	**Exam III**	**Through DNA replication (Ch. 7 – 9**
Week 12	**LearnSmart Chapter 10 due by noon on Monday, 11-15**		
	11-15	Gene Expression I	10.1 - 10.2 (200 - 204)
	11-17	Gene Expression II	10.3 – 10.4 (204 – 211)
	11-19	Gene Expression III	10.5 – 10.6 (211 - 219)
	Peer teaching (peers #3): Feature Investigation 10.9 (Pgs 218 - 220) + additional questions and considerations found within the assignment on canvas		
Week 13	**11-22**	No Class; Friday off (moved to Monday) for extra 10 minutes in other classes	
	11-24 & 26	**NO CLASS: Thanksgiving break**	

Week	Date	Topic	Textbook Reference
Week 14	**EdPuzzle Activity …. And LearnSmart Chapter 14 due by noon on Monday, 11-29**		
	11-29	Chromosomes / cell cycle	14.1 (277 - 282)
	12-1	Mitosis,	14.2 (257 - 262)
	12-3	Meiosis	14.3 (262 - 268)
	Peer teaching (peers #4): Feature Investigation 13.3 (Pgs 271 - 272) + additional questions and considerations found within the assignment on canvas Team Activity #5: Review of Concepts from Chapters 10 and 14		
Week 15	**EdPuzzle activity …. And LearnSmart Chapter 15 due by noon on Monday, 12-6**		
	12-6	Mendelian inheritance I	15.1 – 15.2 (300 – 310)
	12-8	Mendelian inheritance II	15.4 – 15.5 (311 – 317)
	12-10	Seventh Friday off	
Exam IV; Final exam = ~ 1/3 cumulative and 2/3 new material (since last exam). Wednesday 12-15 from 1:30 – 4:00.			

FINAL EXAMINATION POLICY

Successful completion of this class requires taking the final examination **on its scheduled day**. The final examination schedule is posted on the Class Schedules site.