



## **COURSE NUMBER AND TITLE**

NR.110.207 Biochemistry with Lab

## **CREDITS**

4 credits

## **TERM**

Fall 2020

## **PRE- AND COREQUISITES**

NR.110.206 Chemistry with Lab or the equivalent

## **COURSE FACULTY**

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## **COURSE DESCRIPTION**

Biochemistry is a natural science that investigates life processes at the molecular level. This course begins with an introduction to the structure and function of the four classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids. In the second half of the course, glycolysis, the citric acid cycle, and oxidative phosphorylation will provide a context for an introduction to the fundamentals of enzyme catalysis, kinetics, bioenergetics, and metabolic regulation. The virtual lab promotes mastery of the lecture content while exploring lab techniques used in biochemical research. Upon completion, students will have a solid background in the science that provides the foundation of the biomedical sciences.

## **OBJECTIVES**

The course objectives are organized in line with the program outcomes. At the end of the course, the student will be able to:

1. Describe the affect of pH on chemical structure and the relevance to biochemistry.
2. Describe the structure and function of the four classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids.
3. Explain how enzymes increase the rate of biochemical reactions.
4. Explain how animal cells extract and use energy from food.

Syllabus Template Revised June, 2020 (Approved: Masters Curriculum 6/2/20; DNP Curriculum 5/19/20; PhD Curriculum 6/11/20)

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5. Explain how enzymes are used to regulate metabolic pathways.
6. Describe the lab techniques used to study biomolecules.

### REQUIRED TEXTBOOKS AND OTHER COURSE MATERIALS

Pratt, C. & Cornely, K. (2018). *Essential Biochemistry*, (4th ed.). Hoboken, NJ: Wiley.

*Labster*: Students must purchase access to Labster in order to access the lab component of this course. More details on how to purchase can be found in the Syllabus & Course Info area of the classroom

*WileyPLUS*: Students must purchase access to WileyPLUS platform in order to access homework and quiz content. More details on how to purchase can be found in the Syllabus & Course Info area of the classroom

*Access to a reliable computer and internet connection*: It is recommended that students using Windows- based computers should have the Windows 7 or newer operating system, and that Mac users have OS 10.6 or later. We also recommend that you use the most updated version of Google Chrome as your web browser for this course. Other operating systems and web browsers may not be fully supported by the Blackboard and Labster software. Please see the Blackboard course site and the Labster website for detailed system requirements.

### SUMMARY OF LEARNING ASSESSMENTS/ASSIGNMENTS

LEARNING ASSESSMENT/ ASSIGNMENT	COURSE OBJECTIVES ADDRESSED	WEIGHT TOWARD FINAL COURSE GRADE	DUE DATE
Module Graded Quizzes, 10 quizzes in total	1, 2, 3, 4, 5, 6	20%	Dates vary See Course Schedule
Module Homework Assignments, 10 assignments in total	1, 2, 3, 4, 5, 6	20%	Dates vary See Course Schedule
Completion of Lab Sessions and Lab Assignments & Reports, 10 lab sessions in total	1, 2, 3, 4, 5, 6	30%	Dates vary See Course Schedule
Midterm Exam	1, 2, 3, 6	15%	Module 5
Final Exam	1, 2, 3, 4, 5, 6	15%	Module 10

### LEARNING ASSESSMENTS/ASSIGNMENTS

#### Homework Assignments

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Weekly homework assignments are provided online via WileyPLUS. There are 10 homework assignments in this course. Three attempts are allowed for each question or each group of questions. You will find the assignments under the “Assessment” section of each module.

### **Graded Module Quizzes**

These quizzes are designed to test your mastery of the material covered in each module and keep you on track in your reading. They are not timed. The quizzes are open book and open notes. One attempt is allowed for each quiz. There are 10 graded quizzes in total in this course. You will find these quizzes under the “Assessment” section of each module.

### **Lab Sessions**

Laboratory sessions will be completed via the Labster platform, which is linked to the Blackboard Classroom. You are required to complete the related lab assignments for each lab. There are ten labs in total. The maximum point possible for each lab session is 100 points. If you miss a lab session, you will receive 0 for the lab component of that module. There are no makeup labs. An average of 60% must be achieved in the lab component of the course in order for you to pass the course. Links to lab activities and related lab assignments are provided under the “Lab” section of each module in Blackboard.

### **Exams**

Comprehensive exams consisting of multiple choice and short answer questions will be given to assess student understanding of course content. They are open book, open notes and timed. Only one attempt is allowed for each exam. There are no makeup exams.

### **Supplemental Material**

Throughout the course, you will find Practice Questions under the “Optional Learning Activities” section in each module. In addition, eTextbook is also available if you prefer to read the textbook online. These activities provide self-assessment of the information presented in the lectures and the textbook and are not graded or counted towards your final course grade.

## GRADING SCALE

RANGE	LETTER GRADE	GRADE POINT
97 – 100	A+	4.0
93 – 96	A	4.0
90 – 92	A-	3.7
87 – 89	B+	3.3
83 – 86	B	3.0
80 – 82	B-	2.7
77 – 79	C+	2.3
73 – 76	C	2.0
70 – 72	C-	1.7
67 – 69	D+	1.3
63 – 66	D	1.0
60 – 62	D-	0.7
<60	F	0

## HONOR CODE

Students enrolled in the Johns Hopkins University School of Nursing are expected to conduct themselves in a manner that upholds the values of this institution of higher education. Each student is obligated to refrain from violating academic ethics and maintaining high standards of conduct. In addition, the School of Nursing upholds the professional code of ethics established in the Code of Ethics for Nurses (ANA, 2015). Each student is held accountable for adhering to the American Nurses Association Code of Ethics. For the full Johns Hopkins School of Nursing Honor code, please see the current [academic catalog and handbook](#).

## ACADEMIC POLICIES

For a full list of academic policies, please see the current academic catalog and handbook.

## COURSE POLICIES

All course assignments must be turned in by the specified due date and time. Once the due date and time have passed, 10% of the total points you have earned on the assignment will be deducted per day (per 24 hour period). There are no makeup or extra credit assignments allowed, and assignments submitted more than 10 days late will not receive credit. Please contact the course instructor prior to the due date in the case of extenuating circumstances.

## COMMUNICATION POLICY

Students may communicate with the instructor by email, which is provided in the

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Contact Information area. The instructor will respond to students within 48 hours. Assignment feedback will be provided to students within two weeks of submission.

All official communication, notices, & announcements will be distributed through student JHU-SON e-mail accounts via blackboard. The student is accountable for checking this account regularly and for all course communication sent to it.

Students are responsible for reading “Netiquette” which is located under Syllabus & Course Info on the Blackboard site. Netiquette provides simple guidelines for civil on-line discourse & behavior, that participants are to follow and expect of one another.

### **EXAM INTEGRITY & STUDENT IDENTITY VERIFICATION**

This course may require the use of technology and/or software to ensure exam integrity and verify the identity of the student taking the exam. Additional information and directions will be provided in the course website.

### **DISABILITY SERVICES**

If you have a disability and may require accommodation in this course, please contact *Student Disability Services* at (410) 955-7545 or [SON-SDS@jhu.edu](mailto:SON-SDS@jhu.edu) to discuss your specific needs.

## COURSE SCHEDULE

Module	Module Subtopics	Learning Activities & Resources	Learning Assignments/ Assessments
<b>Welcome – Start Here</b>		Familiarize yourself with Blackboard and Labster Labs	Discussion Board: Introduce Yourself Avoiding Plagiarism Module
<b>Module 1: What is Biochemistry?</b>	<ul style="list-style-type: none"> <li>• Chemical Basis of Life</li> <li>• Classes of Biomolecules and Biochemical Polymers</li> <li>• Cells Require Energy to Live, Grow and Reproduce</li> <li>• Gibbs Free Energy and Spontaneous Reactions</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 1 sections 1-3:</b> The Chemical Basis of Life  Review the lecture materials posted in the module for this week.	Module 1 Homework Module 1 Quiz Module 1 Lab Assignment
<b>Module 2: Aqueous Chemistry</b>	<ul style="list-style-type: none"> <li>• Special Properties of Water</li> <li>• Hydrogen Bonding</li> <li>• Hydrophobic Effect</li> <li>• Ionization of Water and pH</li> <li>• Weak Acid Strength Is described by Its <math>pK_a</math></li> <li>• Buffers Resist pH Changes</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 2 sections 1-4:</b> Aqueous Chemistry  Review the lecture materials posted in the module for this week.	Module 2 Homework Module 2 Quiz Module 2 Lab Assignment
<b>Module 3: From Genes to Proteins</b>	<ul style="list-style-type: none"> <li>• Nucleotide Structure</li> <li>• Structure and Function of Nucleotide Derivatives</li> <li>• Nucleic Acid Structure</li> <li>• The Central Dogma of</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 3 sections 1-3:</b> From Genes to Proteins	Module 3 Homework Module 3 Quiz Module 3 Lab Assignment

Module	Module Subtopics	Learning Activities & Resources	Learning Assignments/ Assessments
	Biochemistry <ul style="list-style-type: none"> <li>Amino Acids Are the Building Blocks of Proteins</li> </ul>	<b>Chapter 4 section 1:</b> Protein Structure  Review the lecture materials posted in the module for this week.	
<b>Module 4: Protein Structure and Function</b>	<ul style="list-style-type: none"> <li>Four Levels of Protein Structure</li> <li>Secondary Structures are Stabilized by Hydrogen Bonds</li> <li>Protein Folding and Denaturation</li> <li>Structure and Function of Myoglobin and Hemoglobin</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 4 sections 2-4:</b> Protein Structure <b>Chapter 5 section 1:</b> Protein Function  Review the lecture materials posted in the module for this week.	Module 4 Homework Module 4 Quiz Module 4 Lab Assignment
<b>Module 5: Enzymes</b>	<ul style="list-style-type: none"> <li>Enzymes Increase Reaction Rate</li> <li>Enzymes Stabilize the Transition State</li> <li>Meaning of the Michaelis-Menten Equation</li> <li>Enzyme Inhibition</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 6 sections 1-3:</b> How Enzymes Work <b>Chapter 7 sections 1-3:</b> Enzyme Kinetics and Inhibition  Review the lecture materials posted in the module for this week.	Module 5 Homework Module 5 Quiz Module 5 Lab Assignment
<b>Exam 1</b>		Review content in Module 1 through Module 5	
<b>Module 6:</b>	<ul style="list-style-type: none"> <li>Structure of Membrane Lipids</li> </ul>	Pratt, C. & Cornely, K. (2018).	Module 6 Homework

Module	Module Subtopics	Learning Activities & Resources	Learning Assignments/ Assessments
<b>Lipids and Biological Membranes</b>	<ul style="list-style-type: none"> <li>• Lipid Bilayer</li> <li>• Membrane Proteins and the Fluid Mosaic Model</li> <li>• Thermodynamics of Membrane Transport</li> </ul>	Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 8:</b> Lipids and Membranes  <b>Chapter 9 section 1:</b> Membrane Transport  Review the lecture materials posted in the module for this week.	Module 6 Quiz Module 6 Lab Assignment
<b>Module 7: Carbohydrates</b>	<ul style="list-style-type: none"> <li>• Monosaccharide Structure</li> <li>• Glycosidic Bonds</li> <li>• Polysaccharides</li> <li>• Carbohydrates as an Energy Source</li> <li>• Metabolism Is the Set of All Anabolic and Catabolic Activities</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 11 sections 1 and 2:</b> Carbohydrates <b>Chapter 12 section 1:</b> Metabolism and Bioenergetics  Review the lecture materials posted in the module for this week.	Module 7 Homework Module 7 Quiz Module 7 Lab Assignment
<b>Module 8: Glucose Metabolism</b>	<ul style="list-style-type: none"> <li>• The Glycolysis Reactions</li> <li>• Glycolysis Regulation</li> <li>• Gluconeogenesis Is the Reverse of Glycolysis</li> <li>• Irreversible Steps of Glycolysis Are Bypassed in Gluconeogenesis</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 13 sections 1 and 2:</b> Glucose Metabolism  Review the lecture materials posted in the module for this week.	Module 8 Homework Module 8 Quiz Module 8 Lab Assignment
<b>Module 9:</b>	<ul style="list-style-type: none"> <li>• The Pyruvate Dehydrogenase</li> </ul>	Pratt, C. & Cornely, K. (2018).	Module 9 Homework



Module	Module Subtopics	Learning Activities & Resources	Learning Assignments/ Assessments
<b>Citric Acid Cycle</b>	Reaction <ul style="list-style-type: none"> <li>• Reactions of the Citric Acid Cycle</li> <li>• Citric Acid Cycle Regulation</li> <li>• The Citric Acid Cycle Intermediates Are Amphibolic</li> </ul>	Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 14:</b> The Citric Acid Cycle  Review the lecture materials posted in the module for this week.	Module 9 Quiz Module 9 Lab Assignment
<b>Module 10: Oxidative Phosphorylation</b>	<ul style="list-style-type: none"> <li>• The Reduction Potential of O<sub>2</sub> and Its Reduction to H<sub>2</sub>O</li> <li>• Mitochondrial Electron Transport</li> <li>• Chemiosmosis</li> <li>• ATP Synthase</li> </ul>	Pratt, C. & Cornely, K. (2018). Essential Biochemistry, (4th ed.). Hoboken, NJ: Wiley.  <b>Chapter 15:</b> Oxidative Phosphorylation  Review the lecture materials posted in the module for this week.	Module 10 Homework Module 10 Quiz Module 10 Lab Assignment
<b>Final Exam</b>		Review content in Module 1 through Module 10	