



JOHNS HOPKINS
UNIVERSITY

Course Information

Biochemistry with Lab

NR.110. 207 (4.0 Credits)

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.

Department: NR PP

College: School of Nursing

Course Learning Objectives

Course Learning Outcomes (CLOs):

CLO1 Describe the affect of pH on chemical structure and the relevance to biochemistry.

CLO2 Describe the structure and function of the four classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids.

CLO3 Explain how enzymes increase the rate of biochemical reactions.

CLO4 Explain how animal cells extract and use energy from food.

CLO5 Explain how enzymes are used to regulate metabolic pathways.

CLO6 Describe the lab techniques used to study biomolecules.

Required Text and Other Materials

Required Textbooks and Course Materials:

- Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th 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

Recommended Course Materials:

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

Assessment Summary:

| LEARNING ASSESSMENT/ ASSIGNMENT | COURSE OBJECTIVES ADDRESSED | WEIGHT TOWARD FINAL COURSE GRADE |
|--|-----------------------------|----------------------------------|
| Module Graded Quizzes, 10 quizzes in total | 1, 2, 3, 4, 5, 6 | 20% |
| Module Homework Assignments, 10 assignments in total | 1, 2, 3, 4, 5, 6 | 20% |
| Completion of Lab Sessions and Lab Assignments & Reports, 10 lab sessions in total | 1, 2, 3, 4, 5, 6 | 30% |

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| Midterm Exam | 1, 2, 3, 6 | 15% |
| Final Exam | 1, 2, 3, 4, 5, 6 | 15% |

Learning Assessments/Assignments

Learning Assessments/Assignments:

Homework Assignments

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

Evaluation and Grading

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 |

Course Schedule

Course Schedule:

| Module | Module Subtopics | Learning Activities & Resources | Lea Ass |
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| <p>Welcome Start Here</p> | | <p>Familiarize yourself with Blackboard and Labster Labs</p> | <p>Dis You Play</p> |
| <p>Module 1: What is Biochemistry?</p> | <ul style="list-style-type: none"> • Chemical Basis of Life • Classes of Biomolecules and Biochemical Polymers • Cells Require Energy to Live, Grow and Reproduce • Gibbs Free Energy and Spontaneous Reactions | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 1 sections 1-3: The Chemical Basis of Life</p> | <p>Mo Mo Mo</p> |
| | <p>Review the lecture materials posted in the module for this week.</p> | | |
| <p>Module 2: Aqueous Chemistry</p> | <ul style="list-style-type: none"> • Special Properties of Water • Hydrogen Bonding • Hydrophobic Effect • Ionization of Water and pH • Weak Acid Strength Is described by Its pKa • Buffers Resist pH Changes | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 2 sections 1-5: Aqueous Chemistry</p> | <p>Mo Mo Mo</p> |
| | <p>Review the lecture materials posted in the module for this week.</p> | | |

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| <p>Module 3: From Genes to Proteins</p> | <ul style="list-style-type: none"> • Nucleotide Structure • Structure and Function of Nucleotide Derivatives • Nucleic Acid Structure • The Central Dogma of Biochemistry • Amino Acids Are the Building Blocks of Proteins | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 3 sections 1-3: From Genes to Proteins</p> <p>Chapter 4 section 1: Protein Structure</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo</p> <p>Mo</p> <p>Mo</p> |
| <p>Module 4: Protein Structure and Function</p> | <ul style="list-style-type: none"> • Four Levels of Protein Structure • Secondary Structures are Stabilized by Hydrogen Bonds • Protein Folding and Denaturation • Structure and Function of Myoglobin and Hemoglobin | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 4 sections 2-4: Protein Structure</p> <p>Chapter 5 section 1: Protein Function</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo</p> <p>Mo</p> <p>Mo</p> |

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| <p>Module 5: Enzymes</p> | <ul style="list-style-type: none"> • Enzymes Increase Reaction Rate • Enzymes Stabilize the Transition State • Meaning of the Michaelis- Menten Equation • Enzyme Inhibition | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 6 sections 1-3: How Enzymes Work</p> <p>Chapter 7 sections 1-3: Enzyme Kinetics and Inhibition</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |
| <p>Exam 1</p> | | <p>Review content in Module 1 through Module 5</p> | |
| <p>Module 6: Lipids and Biological Membranes</p> | <ul style="list-style-type: none"> • Structure of Membrane Lipids • Lipid Bilayer • Membrane Proteins and the Fluid Mosaic Model • Thermodynamics of Membrane Transport | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 8: Lipids and Membranes</p> <p>Chapter 9 section 1: Membrane Transport</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |

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| <p>Module 7: Carbohydrates</p> | <ul style="list-style-type: none"> • Monosaccharide Structure • Glycosidic Bonds • Polysaccharides • Carbohydrates as an Energy Source • Metabolism Is the Set of All Anabolic and Catabolic Activities | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 11 sections 1 and 2: Carbohydrates</p> <p>Chapter 12 section 1: Metabolism and Bioenergetics</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |
| <p>Module 8: Glucose Metabolism</p> | <ul style="list-style-type: none"> • The Glycolysis Reactions • Glycolysis Regulation • Gluconeogenesis Is the Reverse of Glycolysis • Irreversible Steps of Glycolysis Are Bypassed in Gluconeogenesis | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 13 sections 1 and 2: Glucose Metabolism</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |

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| <p>Module 9: Citric Acid Cycle</p> | <ul style="list-style-type: none"> • The Pyruvate Dehydrogenase Reaction • Reactions of the Citric Acid Cycle • Citric Acid Cycle Regulation • The Citric Acid Cycle Intermediates Are Amphibolic | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 9 sections 1-3</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |
| <p>Module 10: Oxidative Phosphorylation</p> | <ul style="list-style-type: none"> • The Reduction Potential of O₂ and Its Reduction to H₂O • Mitochondrial Electron Transport • Chemiosmosis • ATP Synthase | <p>Pratt, C. & Cornely, K. (2021). Essential Biochemistry, (5th ed.). Hoboken, NJ: Wiley.</p> <p>Chapter 15: Oxidative Phosphorylation</p> <p>Review the lecture materials posted in the module for this week.</p> | <p>Mo Mo Mo</p> |
| <p>Final Exam</p> | | <p>Review content in Module 1 through Module 10</p> | <p>Ope</p> |