



CHE351-D: Biochemistry

Credit Hours: 4

Content Hours: This is a 4-credit course, offered in an accelerated format. This means that 16 weeks of material is covered in 8 weeks. The exact number of hours per week that you can expect to spend on each course will vary based upon the weekly coursework, as well as your study style and preferences. You should plan to spend 14-20 hours per week in each course reading material, interacting on the discussion boards, writing papers, completing projects, and doing research.

Faculty Information: Faculty contact information and availability can be found on the announcements.

COURSE DESCRIPTION AND OUTCOMES

Course Prerequisite Knowledge:

BIO181-D and CHE345-D are recommended.

Course Description:

Through lecture and lab experience, students successfully completing this course will demonstrate an understanding of structure and function of biological molecules, metabolism, and energy transduction.

Course Learning Outcomes:

1. Evaluate the main components and side chains unique to proteins, nucleic acids, lipids, and carbohydrates and their impact to cellular structure, cell signaling, and metabolism.
2. Discover the role and regulation of proteins, nucleic acids, lipids, and carbohydrates in physiological and pathological conditions.
3. Evaluate how the rate of enzymes in chemical reactions are controlled by the cellular environment.
4. Analyze the processes for the breakdown of sugar (glycolysis and the citric acid cycle) and its impact on energy (ATP) production.
5. Examine how your body uses fat (lipid) metabolism to generate membranes and store energy for later use.
6. Decipher gene expression, protein translation, and their relevant cellular functions.
7. Distinguish how external environmental cues can affect gene expression.
8. Apply how the central dogma of biochemistry leads from DNA to RNA to protein to all the metabolic functions in the body.

COURSE ALIGNMENT

CSU Global has developed this course to align with current in-demand job skills. In the table below, the Course learning outcomes are aligned with in-demand job skills and the course assignments and assessments. This information is provided so that students can clearly articulate the job skills achieved and the product of that achievement as they explore current and future career opportunities.

Course Skill Alignment

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
Analyze the distinct components and side chains of proteins, nucleic acids, lipids, and carbohydrates, and their influence on cell structure,	• The ability to comprehend and apply frameworks related to the regulation of biomolecules in different physiological and pathological conditions. Students will develop a comprehensive understanding	• Submitting an assignment such as Critical Thinking Assignment 1 • Posting to a graded discussion board 1 • Responding to a post on a graded discussion board 1

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
signaling, and metabolism.	of molecular structure and function in biochemistry. • This includes a deep knowledge of chemical properties, structural characteristics, and functional roles of proteins, nucleic acids, lipids, and carbohydrates. • Students will need to grasp the underpinnings of how these biomolecules interact with each other and with cellular components.	• Lab assignment
Discover the role and regulation of proteins, nucleic acids, lipids, and carbohydrates in physiological and pathological conditions	• Understand the principles of molecular interactions, biochemical pathways, and cellular signaling to analyze the roles and regulatory mechanisms of biomolecules in both normal and pathological cellular processes. • Additionally, students will need to develop a deep understanding of how these biomolecules function individually and in concert to maintain cellular homeostasis and respond to external stimuli or pathological conditions.	• Critical Thinking Module 2 • Posting to a graded discussion board 2 • Responding to a post on a graded discussion board • Lab assignment
Evaluate how the rate of enzymes in chemical reactions are controlled	• Comprehension of Enzyme Kinetics; Proficiency in understanding the fundamental concepts of enzyme kinetics,	• Critical Thinking Module 3 • Posting to a graded discussion board 3

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
by the cellular environment.	including Michaelis Menten kinetics, interactions between enzymes and substrates and the various factors that can influence enzyme activity. • Understanding Cellular Factors; Thorough knowledge of the theoretical aspects related to cellular factors that have an impact on enzyme activity, such as pH levels, temperature, concentration of substrates and the presence of substances that can either inhibit or activate enzymes. • Molecular Interactions; Grasp on the theoretical principles governing molecular interactions, including the significance of non covalent bonds, conformational changes and allosteric regulation in controlling enzyme activity within a cellular setting. • Integration with Biological Context; Capacity to integrate theoretical knowledge about enzyme function with a broader understanding of biological contexts encompassing cellular signaling pathways, metabolic regulation mechanisms and	• Responding to a post on a graded discussion board 3 • Labster assignment

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
	how the cellular environment influences enzyme activity. • Proficiency in understanding and applying theoretical principles of enzymes kinetics to analyze the factors influencing enzyme activity	
Analyze the processes for the breakdown of sugar (glycolysis and the citric acid cycle) and its impact on energy (ATP) production.	• Demonstrating understanding in comprehending the fundamental principles of glycolysis and the citric acid cycle, including the sequential biochemical reactions, the significance of specific enzymes and the production of energy intermediates like ATP and NADH. • Demonstrate the ability to connect theoretical knowledge of metabolic pathways with broader concepts in biochemistry, such as redox reactions, substrate level phosphorylation and how energy production is linked to cellular processes. • Applying theoretical principles from thermodynamics and energetics to analyze the potential yield of ATP from sugar breakdown and grasp the fundamental basis for conserving and utilizing energy in cellular metabolism.	• Module 5 critical thinking and discussion • Lab assignment

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
Examine how your body uses fat (lipid) metabolism to generate membranes and store energy for later use.	• Proficiency in understanding the underlying principles of lipid metabolism, which involve processes like lipolysis, beta oxidation and the creation of lipids such as phospholipids and cholesterol. • Comprehensive understanding of the aspects related to membrane biogenesis including the significance of lipid bilayers, membrane proteins and how newly synthesized lipids are incorporated into cellular membranes. • The ability to connect knowledge of lipid metabolism with broader concepts, like energetics and anabolism. This includes understanding how much ATP can be potentially generated from lipid oxidation and comprehending the principles that govern the synthesis of complex lipids for both membrane formation and energy storage.	• Critical Thinking Module 6 • Posting to a graded discussion board 6 • Labster assignment
Decipher gene expression, protein translation, and their relevant cellular functions.	• Students will be able to describe DNA structure and function, including the processes of replication, transcription, and translation, and explain how these molecular processes	• Critical Thinking Module 7 • Posting to a graded discussion board 7 • Responding to a post on a graded discussion board 7 • Labster assignment

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
	contribute to the storage and expression of genetic information. • Proficiency in understanding the concepts of molecular biology, which include the structure and function of DNA, RNA and proteins. Additionally a comprehensive grasp of how genes are expressed through processes like transcription and translation. • A thorough understanding of the aspects pertaining to cellular signaling pathways gene regulation mechanisms and post translational modifications. Recognizing their significance in coordinating gene expression and protein functions within a cell. • The ability to integrate knowledge of gene expression and protein translation with broader biochemical pathways and cellular functions. This includes comprehending the underlying principles that govern the relationship between gene regulation, protein synthesis and specific cellular processes such as metabolism, cell signaling, and cell cycle control.	

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
Distinguish how external environmental cues can affect gene expression.	• Proficiency in grasping the underlying principles of epigenetics, such as DNA methylation, modifications to histones, and the regulation of coding RNA. This knowledge allows for an understanding of how external signals can impact the activation or suppression of genes. • An understanding of the theoretical aspects related to signal transduction pathways and how they regulate gene expression. This knowledge enables us to interpret how external stimuli influence gene activity through communication. • The ability to combine knowledge from environmental biology with biochemical principles. This integration helps us comprehend the mechanisms through which external environmental cues affect gene expression and cellular responses.	• Critical Thinking • Lab • Discussion
Apply how the central dogma of biochemistry leads from DNA to RNA to protein to all the metabolic functions in the body.	• A strong grasp of the concepts of molecular genetics, including DNA replication, transcription, and translation. This understanding allows one to comprehend how genetic	• Critical Thinking • Lab

In this course you will: (Course Learning Outcome)	In-Demand Skill	Where you will demonstrate your learning (Assignment)
	information flows from DNA to RNA to proteins. • The ability to connect the knowledge of the central dogma with broader concepts in systems biology. This integration helps establish links between the flow of information and the regulation of metabolic pathways and cellular functions within the theoretical framework of the central dogma. • Application of theoretical principles to examine how gene expression products, specifically proteins, coordinate and regulate various metabolic functions within an organism. This analysis enables a connection between the dogma and wider biochemical pathways as well as cellular processes.	

COURSE MATERIALS

Required:

LaunchPad for *Tymoczko's biochemistry: A short course* (4th edition) 6-month access

ISBN-13: 9781319234379

Tools:

This course requires the use of a tool called **Labster**, which allows you to interact with a virtual science lab. You will see a charge in your student account for the use of this tool.

NOTE: *All non-textbook required readings and materials necessary to complete assignments, discussions, and/or supplemental or required exercises are provided within the course itself. Please read through each course module carefully.*

Note: To print this syllabus or any of your lecture content, please follow the steps below:

- Go to the page you want to print
 - If you are using a PC, use the shortcut CTRL + P
 - If you are using a Mac, use the shortcut COMMAND + P
 - Repeat as necessary on any page you want to print.
-

PARTICIPATION & ATTENDANCE

Prompt and consistent attendance in your online courses is essential for your success at CSU Global Campus. Failure to verify your attendance within the first seven (7) days of this course may result in your withdrawal. If, for any reason, you would like to drop a course, please contact your advisor.

In order to verify your attendance throughout this course, CSU Global encourages you to actively engage during every week of the term. Active engagement includes the following tasks:

- Submitting an assignment
- Completing a mastery exercise
- Posting to a graded discussion board
- Responding to a post on a graded discussion board

You must engage in one of the aforementioned tasks to verify your attendance within the first official week of the course (Monday through Sunday, not including the open house). Otherwise, you may be dropped from this course.

Academic engagement will be monitored on a weekly basis. Students who have not actively engaged for 14 consecutive days will receive an At-Risk Email requesting that the student academically engage in their course within seven days, or they will be administratively withdrawn from courses. If the student has not participated after 21 days, the student will be administratively withdrawn from the course.

Online classes have deadlines, assignments, and participation requirements similar to any other college class. Budget your time carefully and keep an open line of communication with your instructor. If you are having technical problems, problems with your assignments, or other problems that are impeding your progress, let your instructor know as soon as possible.

COURSE SCHEDULE

The Academic Week at CSU Global begins on Monday and ends the following Sunday. The following components are present in this course: (NOTE: Only list components actually required in the course)

- **Readings:** There are weekly required readings in addition to the interactive lectures. The readings may include chapters from the required textbook, or linked articles, videos and other resources. Review the For Your Success page of the Interactive Module Lectures for details about the assigned readings.
- **Discussion Boards:** There is a Discussion Board assignment in Modules 3, 5, and 7, each worth 25 points. The original post must be completed by Thursday at 11:59 p.m. MT and Peer Responses posted by Sunday 11:59 p.m. MT. Late posts may not be awarded points.
- **Labs:** These are due Sunday at 11:59 p.m. MT of the week assigned.
- **Critical Thinking Assignments:** These are due Sunday at 11:59 p.m. MT of the week assigned.

GRADEBOOK

MODULE#	LABS	Critical Thinking Assignments	DISCUSSIONS
1	40	40	40
2	40	45	40
3	40	45	40
4	40	45	40
5	45	55	40
6	45	55	40
7	45	55	40
8	45	0	40

MODULE#	LABS	Critical Thinking Assignments	DISCUSSIONS
TOTALS 1000 POINTS	340	340	320

Grading Scale:

Grade	Range
A	100 % to 95.0%
A-	< 95.0 % to 90.0%
B+	< 90.0 % to 86.7%
B	< 86.7 % to 83.3%
B-	< 83.3 % to 80.0%
C+	< 80.0 % to 75.0%
C	< 75.0 % to 70.0%
D	< 70.0 % to 60.0%
F	< 60.0 % to 0.0%

STUDENT POLICIES

All students are expected to adhere to the [University Student Policies](https://csuglobal.edu/student-policies)  (<https://csuglobal.edu/student-policies>). These include such things as academic integrity, artificial intelligence, netiquette, course evaluations, late work, incomplete grade policies, and more. For

comprehensive documentation of CSU Global institutional policies, refer to the Policies section in the Academic Catalog.

Course Summary:

Date	Details	Due
	 <u>Module 1: Critical Thinking Assignment</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723842)	
	 <u>Module 1: Introduction Discussion</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723941)	
	 <u>Module 1: Lab Report (Part 2)</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723841)	
	 <u>Module 1: Labster (Part 1)</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723840)	
	 <u>Module 2: Critical Thinking Assignment</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723845)	
	 <u>Module 2: Discussion</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723863)	
	 <u>Module 2: Lab Report (Part 2)</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723844)	
	 <u>Module 2: Labster (Part 1)</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723843)	
	 <u>Module 3: Critical Thinking Assignment</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723848)	
	 <u>Module 3: Discussion</u> (https://csuglobal.instructure.com/courses/85799/assignments/1723837)	
	 <u>Module 3: Lab Report (Part 2)</u>	

Date	Details	Due
	https://csuglobal.instructure.com/courses/85799/assignments/1723847	
	 Module 3: Labster (Part 1) https://csuglobal.instructure.com/courses/85799/assignments/1723846	
	 Module 4: Critical Thinking Assignment https://csuglobal.instructure.com/courses/85799/assignments/1723851	
	 Module 4: Discussion https://csuglobal.instructure.com/courses/85799/assignments/1723864	
	 Module 4: Lab Report (Part 2) https://csuglobal.instructure.com/courses/85799/assignments/1723850	
	 Module 4: Labster (Part 1) https://csuglobal.instructure.com/courses/85799/assignments/1723849	
	 Module 5: Critical Thinking Assignment https://csuglobal.instructure.com/courses/85799/assignments/1723854	
	 Module 5: Discussion https://csuglobal.instructure.com/courses/85799/assignments/1723838	
	 Module 5: Lab Report (Part 2) https://csuglobal.instructure.com/courses/85799/assignments/1723853	
	 Module 5: Labster (Part 1) https://csuglobal.instructure.com/courses/85799/assignments/1723852	
	 Module 6: Critical Thinking Assignment https://csuglobal.instructure.com/courses/85799/assignments/1723857	
	 Module 6: Discussion https://csuglobal.instructure.com/courses/85799/assignments/1723865	
	 Module 6: Lab Report (Part 2) https://csuglobal.instructure.com/courses/85799/assignments/1723856	
	 Module 6: Labster (Part 1)	

Date	Details	Due
	(https://csuglobal.instructure.com/courses/85799/assignments/1723855)	
	 Module 7: Critical Thinking Assignment (https://csuglobal.instructure.com/courses/85799/assignments/1723860)	
	 Module 7: Discussion (https://csuglobal.instructure.com/courses/85799/assignments/1723839)	
	 Module 7: Lab Report (Part 2) (https://csuglobal.instructure.com/courses/85799/assignments/1723859)	
	 Module 7: Labster (Part 1) (https://csuglobal.instructure.com/courses/85799/assignments/1723858)	
	 Module 8: Discussion (https://csuglobal.instructure.com/courses/85799/assignments/1723866)	
	 Module 8: Lab Report (Part 2) (https://csuglobal.instructure.com/courses/85799/assignments/1723862)	
	 Module 8: Labster (Part 1) (https://csuglobal.instructure.com/courses/85799/assignments/1723861)	