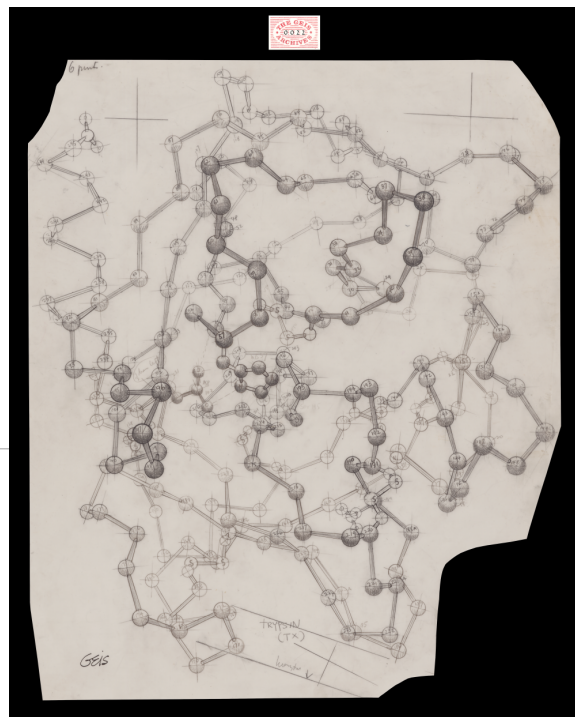




BIOCHEMISTRY I

The University of Toledo
College of Natural Sciences and Mathematics
Department of Chemistry and Biochemistry
CHEM 3510-001, 091
Fall 2021

Instructor:	Dr. John Bellizzi
Email:	john.bellizzi@utoledo.edu
Office Hours (Virtual):	M/W 1:15-2:15 pm and by appointment
Office Location:	Wolfe Hall 4203A
Instructor Phone:	(419) 530-5926
Course Website:	https://blackboard.utdl.edu
Class Location:	Synchronous Remote
Class Day/Time:	M/W/F 10:20 am-11:15 am
Credit Hours:	3



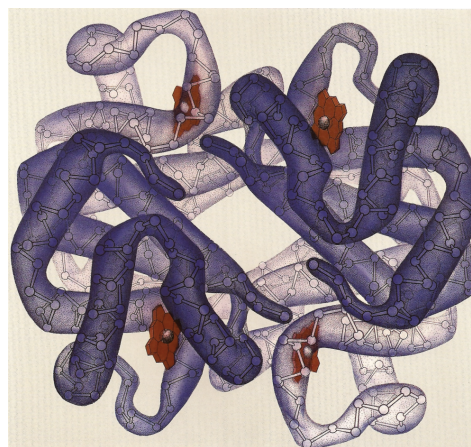
CATALOG/COURSE DESCRIPTION

The chemistry of living systems, beginning with the structures and molecular and biological functions of proteins, nucleic acids, carbohydrates, and lipids. Other topics include enzyme kinetics and mechanism, biological membranes and membrane transport, and signal transduction.

COURSE OVERVIEW/ TEACHING METHODOLOGY

- Biochemistry I will be taught in a synchronous remote format during Fall 2021.
- Synchronous classes will be held on Blackboard Collaborate Ultra (<https://blackboard.utdl.edu>) on Monday, Wednesday, and Friday from 10:20–11:15 am starting Monday, August 30, 2021.
- The electronic textbook (*Lehninger Principles of Biochemistry* 8th Ed) and homework is on the Macmillan Achieve platform (<https://achieve.macmillanlearning.com/courses/hugupa/>).
- Five quizzes and two exams will be taken on Blackboard using Respondus Lockdown browser and monitor.
- Class format will be primarily lecture with some class discussion and small group active learning exercises.
- When participating in class discussions, small group exercises, and office hours, students are required to have their webcams and microphones enabled. During lecture, students are encouraged to make use of the text chat to ask questions and have their cameras enabled.
- There will be readings from the textbook assigned for each class, and the lecture and discussion will assume that you have already done the reading. Problem sets, quizzes and exams will cover all material in the assigned readings (whether or not it is discussed in class) as well as material covered in class that is not in the textbook. The course will cover Chapters 1-12 of *Lehninger*.
- Incomplete lecture slides (with room to add information that will be filled in during class) will be posted on Blackboard in PDF format.
- Lectures will be recorded and will be available for later viewing within Blackboard Collaborate Ultra and will also be posted to Echo 360.
- The course is being designed for synchronous participation, and attendance and participation in discussions and small group activities is required. Attendance will be recorded, and attendance and class participation will be considered when calculating final course grades if a student ends up near the boundary between two letter grades.

BIOCHEMISTRY I



STUDENT LEARNING OUTCOMES

Upon successful completion of this course, students will be able to:

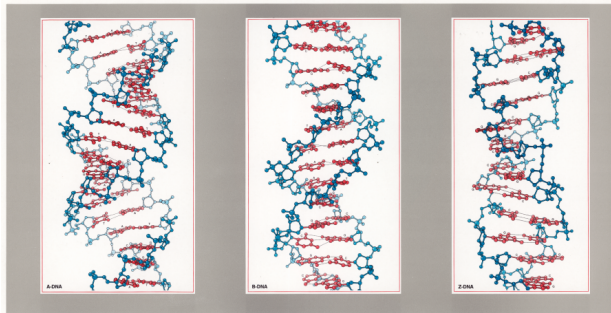
1. Identify, name, and draw chemical structures of amino acids, nucleotides, monosaccharides, disaccharides, polysaccharides, and common storage and membrane lipids.
2. Understand how intermolecular forces and the hydrophobic effect lead to the formation of three-dimensional structures of biomolecules and intermolecular complexes.
3. Describe how the biological functions of proteins, nucleic acids, polysaccharides, and lipid assemblies are dependent on their covalent structures, stereochemistry, conformations, and the properties and reactivities of their component functional groups.
4. Use the Henderson-Hasselbalch equation to relate pH, pK_a and concentrations of weak acids and conjugate bases.
5. Calculate isoelectric points and net charges for amino acids, peptides, and other molecular ions.
6. Interpret protein and nucleic acid sequencing data.
7. Classify enzymes based on the type of reaction they catalyze.
8. Mathematically and graphically describe protein-ligand equilibria and the kinetics of enzyme-catalyzed reactions.
9. Draw the chemical mechanisms of enzyme-catalyzed reactions using curved arrow notation and extrapolate from specific reactions studied in class to propose mechanisms for other enzymes that carry out similar reactions.
10. Recognize, classify, and explain important cellular functions carried out by proteins, including transport of solutes across membranes and intracellular signal transduction, and describe general principles and specific examples of these pathways.
11. Integrate knowledge from other courses and fields (e.g., organic chemistry, biology) with biochemistry.

PREREQUISITE

The prerequisite is a C- or better in CHEM 2420 Organic Chemistry II (D- or better for students with a catalog year prior to Fall 2017). Students not satisfying the prerequisite will be dropped from the course. There are many concepts critical to mastering biochemistry that you are expected to already know from General and Organic Chemistry. If you do not feel proficient in the areas below you are advised to go back and review them.

- Lewis structures, formal charges, and resonance
- Covalent bonding, hybridization, and molecular geometry (VSEPR)
- Conformational analysis of open chains (staggered/eclipsed/gauche/anti) and rings (puckered/boat/chair)
- Stereochemistry – *cis/trans* and chiral centers (enantiomers, diastereomers)
- Intermolecular forces (electrostatic, dipole-dipole, dispersion forces, hydrogen bonds)
- Thermodynamics (ΔG , ΔH , ΔS), equilibrium (K_{eq}), kinetics (first order and second order rate equations)
- Ionization of weak acids; acid/base strength (pK_a , pH)
- Structures, properties, and names of organic functional groups
- Reactions and mechanisms
 - Acid-base reactions
 - Carbonyl reactions (additions, eliminations, acyl substitutions)
 - Nucleophilic substitution and β -elimination
- How to use curved arrows to trace the flow of electron pairs in reaction mechanisms

BIOCHEMISTRY I



COURSE MATERIALS

Required: Macmillan Achieve Biochemistry access code, which includes integrated e-book version of Nelson, D.L. and Cox, M.M. *Lehninger Principles of Biochemistry* (8th Edition, 2021).

Macmillan Achieve and the integrated *Lehninger* text are used for both CHEM 3510 and CHEM 3520.

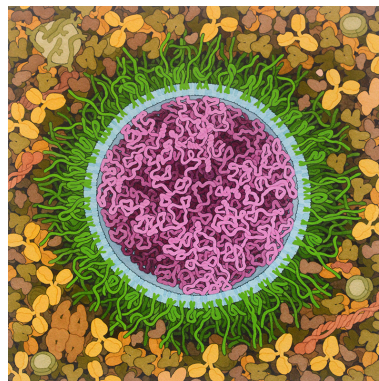
You only have to purchase one of the following three options.

1. **If you are only taking CHEM 3510:** Purchase a **single semester access code (ISBN 9781319230906)** for \$99.99 online at the [Macmillan Student Store](#) or for \$114.29 at the bookstore.
2. **If you will also be taking CHEM 3520 in Spring 2022:** Purchase a **two-semester access code (ISBN 9781319322328)** for \$114.99 online at the [Macmillan Student Store](#) or for \$118.29 at the bookstore. This will cover access for both CHEM 3510 and 3520, so you will not have to purchase anything additional for next semester.
3. If you want a physical copy of the book in addition to the access code/e-book, there are several options. The bookstore is offering a hard copy (loose-leaf) version of the textbook bundled with a single semester Achieve access code for \$160.00. ISBN 9781319408886. [The Macmillan Student Store](#) has other options for hard copies available (loose-leaf or paperback print copy bundled with one or two semester Achieve access code).
 - Whichever option you choose, you will retain access to the electronic textbook through Macmillan VitalSource for 4 years.
 - Reading assignments begin immediately and the first problem set due **Wednesday September 8 at 11:59 pm**, so you should create an Achieve account and enroll in the course on Achieve without delay so you can access the book and begin working on the assignments. Note that there is a 14-day “grace period” that allows you to access the materials and begin work on the class if you are unable to pay for access right away.
 - To enroll in the course on Achieve, go to this link: <https://achieve.macmillanlearning.com/courses/hugupa/>. You will be prompted to log in or create an account. After doing so, you will be given the option to purchase access to the course, enter a previously purchased access code, or enroll in the course using the 14-day grace period (and purchase/enter an access code before the grace period is over).

TECHNOLOGY REQUIREMENTS

- Students will need a computer with reliable internet access, a webcam, and a microphone to access course material, participate in class sessions and office hours, and take quizzes and exams.
- All course material and activities will be linked from the course Blackboard page. Students should also check their rockets.utoledo.edu e-mail daily and use this e-mail address for all course-related correspondence.
- Students are responsible for making sure their operating system and browser can access course material on the following platforms: Blackboard, Echo360, Blackboard Collaborate Ultra, and Macmillan Achieve. Documentation for Blackboard, Echo360, and Blackboard Collaborate Ultra can be found here: <http://utlv.screenstepslive.com/s/student>. System requirements for Macmillan Achieve can be found here: <https://macmillan.force.com/macmillanlearning/s/achieve>.
- Students will be required to download and use the Respondus Lockdown Browser and Monitor for secure quizzes and exams and webcam-based proctoring. Information on Respondus Lockdown Browser can be found here: <http://utlv.screenstepslive.com/s/student/m/61901>.
- Some exam questions will require handwritten responses. Students will need a method of capturing handwritten responses for upload (scanner or digital camera, preferably using a camera scanning app).
- Important links for technical assistance:
 - UT Online Help Desk: <https://www.utoledo.edu/dl/helpdesk/>
 - Macmillan Achieve: <https://macmillan.force.com/macmillanlearning/s/achieve>

BIOCHEMISTRY I



OVERVIEW OF COURSE GRADE ASSIGNMENT

Final Grading

Final grades will be assigned based on a total of 400 possible points:

Problem Sets (12 x 5 points)	60 points
Quizzes (5 quizzes worth 10 points each; lowest quiz dropped)	40 points
Midterm Exam	100 points
Comprehensive Final Exam	200 points
Attendance and participation	*

Letter grades will be assigned based on the following cutoffs for percentage of total possible points.

	A $\geq 90\%$	90% > A- $\geq 88\%$	
88% > B+ $\geq 86\%$	86% > B $\geq 80\%$	80% > B- $\geq 78\%$	
78% > C+ $\geq 76\%$	76% > C $\geq 70\%$	70% > C- $\geq 68\%$	
68% > D+ $\geq 66\%$	66% > D $\geq 60\%$	60% > D- $\geq 58\%$	58% > F

Notes:

- Depending on exam averages and final grade distributions, the above cutoffs may be lowered but will not be raised.
- Grades will not be curved.
- Because the final exam is comprehensive, if a student gets a higher percentage grade on the final exam (out of a possible 200), than their total percentage of course points (out of a possible 400), the letter grade will be assigned based on the final exam grade only. In other words, the letter grade will be based on the higher of the total course grade percentage or the final exam grade percentage.
- *In cases where a student's final percentage puts them close to a boundary between letter grades, the student's class attendance and participation in group exercises and class discussions will be considered.

Midterm Grading

Midterm grades will be calculated and posted in late October and will be based on your scores on the Midterm exam, the first two quizzes, and Problem Sets 1-5 (a total of 145 points). Your percentage of possible points earned will be converted to a letter grade based on the grade scale above.

COURSE EXPECTATIONS

Academic Honesty

- The University of Toledo [Policy on Academic Dishonesty](#) will be strictly enforced.
- Students are encouraged to study together and are permitted to work together on problem sets. However, each student must submit their own answers while logged into their own Achieve account.
- Quizzes and exams are closed book, closed notes. You are not permitted to use any notes, books, or other resources (electronic or physical) or consult any other people in the process of completing a quiz/exam. With the exception of a calculator, no other electronic devices besides the computer/tablet running Lockdown browser may be used during the quiz or exam. Quizzes/exams must be taken using Lockdown browser and a webcam must be enabled for remote proctoring. A photo ID (student ID or driver's license) is required for each quiz/exam.
- Any student caught cheating in any way or facilitating the cheating of others will receive a 0 for that quiz/exam. A second violation or an egregious first violation will result in an F in the course and referral to the Dean's Office.
- Posting homework/quiz/exam questions online or searching for answers online (including but not limited to use of sites like Chegg or CourseHero) is not permitted and will be considered academic misconduct. Graded assignments are meant to assess how well you are learning the material, not your skills in internet searching or crowdsourcing.

BIOCHEMISTRY I

Office Hours

- I will hold regularly scheduled virtual office hours in the Course Room on Blackboard Collaborate Ultra Mondays and Wednesdays from 1:15 pm – 2:15 pm. Anyone may drop in during this time with no need for an appointment.
- To schedule an appointment for virtual office hours with some preferred days and times (between 10 am and 6 pm M-F), and I will do my best to accommodate your request.

Homework

Homework will be on the Macmillan Achieve platform, which is integrated with the e-textbook. Within the Achieve course page, there will be a folder for each week of the course that will contain reading assignments and graded homework for that week, as well as other optional ungraded activities relevant to that week's material.

Reading assignments

- Sections from *Lehninger* will be assigned for each week, and links to the readings for each week can be found in that week's folder on Achieve. You are expected to complete the reading before each class. The course will be moving very quickly, so pacing yourself and keeping up with the reading is important. Problem sets, quizzes and exams will cover material in the assigned reading as well as material covered in lecture.
- Achieve also includes optional ungraded activities such as "skills you need" for each chapter, adaptive quizzes on chapter content, and links to definitions of key terms that will be of assistance in understanding the material from the readings.

Problem sets (graded homework)

- The 12 weekly problem sets are worth a total of 60 points (12 problem sets x 5 points each = 60 points).
- Problem Sets 1-11 will be due Wednesdays by 11:59 pm (starting on Wednesday Sept 8). There is no problem set due the week of the mid-term exam.
- Problem Set 12 will be due Friday Dec 10 by 11:59 pm
- You may attempt questions more than once, but you will lose 10% of the possible credit for each incorrect attempt.
- Late problem sets will be accepted but will lose 20% of the total assignment credit for each day or partial day they are late. 0-24 h late = max score = 4 points, 24-48 h late max score = 3 points, etc.

Goal setting and reflection surveys

- An initial survey on your expectations and goals for the course, as well as periodic follow-up surveys, allow you to carry out self-assessment and provide me some feedback on your progress in the course. For each survey that you complete before the due date, you will be given 1 extra credit point, which will be added to your final course total.

Ungraded activities

- In addition to the chapter skill checks, quizzes, and key terms mentioned above, there are other ungraded resources and activities (including 3D molecular structure tutorials, videos, and additional readings) that will be available for various topics Achieve. You are highly encouraged to take advantage of these resources as you study, but they will not count towards your grade.

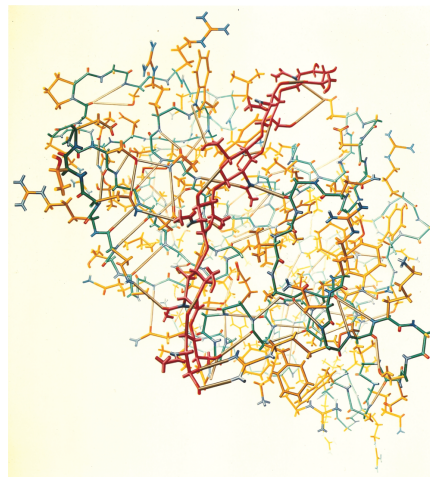
Topics for in class discussion/small group activities

- Periodically I will assign a topic, a question, or a short reading in class that will be the basis of a short discussion or small group active learning activity in the next class. You should spend some time thinking about this topic/question before the next class to be prepared to participate in the discussion/activity.

BIOCHEMISTRY I

Quizzes and Examinations

- Quizzes and exams will require you to use Respondus Lockdown Browser and have a webcam enabled for remote proctoring. You will also need a photo ID and a calculator. Exams and quizzes are closed book and closed notes. There will be five short (10 minute) quizzes. These quizzes will be in the first 10 minutes of the class period (10:20-10:30) on the following dates: **Friday Sept 17, Friday October 1, Friday October 19, Friday November 21, and Friday December 3.** Class will begin those days at 10:30.
 - Each quiz will be worth 10 points, and the lowest of your five quiz scores will be dropped (total of 40 points of your course grade)
 - Topics will be announced a week in advance of each quiz
 - The quizzes will consist of 5-10 multiple-choice, matching, and fill-in-the blank style questions.
- There will be a midterm examination on **Wednesday October 13 during the normal class time (10:20-11:15).** You may access the exam any time between 10:20 and 11:00 am, and once you complete the ID/environment check and begin the exam, you will have 55 minutes to complete it.
- There will be a comprehensive final examination on **Monday December 13 during finals week at the time designated by the registrar (10:15 am- 12:15 pm).** You may access the exam any time between 10:15 and 11:00 am, and once you complete the ID/environment check and begin the exam, you will have 120 minutes to complete it.
- For the mid-term and final examinations will be two sections of each exam – one containing questions that you will answer directly in the browser window (short answer, matching/multiple choice, fill in the blank, longer written answers), and one containing questions that will require handwritten answers on paper (drawing structures, graphs, or reaction mechanisms). You will be required to show your handwritten pages to the webcam before submitting the exam, and then scan or photograph your handwritten answers and upload them for grading. You will have 15 minutes from the time you submit the exam to scan or capture your handwritten answers and upload them to the link provided on Blackboard or e-mail them to me as a PDF attachment to from your rockets.utoledo.edu e-mail address. If your handwritten answers are not received within 15 minutes of the timestamp for your exam submission, they will not be graded.
- If you experience technological challenges beyond your control (power outage, internet outage, etc.) that impair your ability to complete the exam and/or capture and submit your written answers in the allotted time, e-mail me as soon as you are able with specific details about the challenge, and I will work with you to find an appropriate solution.
- Exams must be taken at the date and time scheduled unless the student has a conflict that meets the criteria of the [UT Missed Class Policy](#) (personal emergencies, including, but not limited to, illness of the student or of a dependent of the student or death in the family; religious observances that prevent the student from attending class; participation in University-sponsored activities, approved by the appropriate University authority, government-required activities, such as military assignments, jury duty, or court appearances).
- If you have a conflict with an exam or quiz that you know about in advance, contact me and I will arrange for you to take the exam **early**. It is your responsibility to contact me with documentation to make these arrangements as soon as you are aware of the conflict.
- For legal absences with no prior notice (such as medical emergencies), acceptable written documentation justifying the absence is required before an excused absence will be considered. If you are granted an excused absence, you will be given a make-up exam, which you must complete as soon as is feasible after your legal absence is concluded.





BIOCHEMISTRY I

UNIVERSITY POLICIES

Academic Policies: <http://www.utoledo.edu/policies/academic/undergraduate/>

Drop/Withdraw: The course may be dropped on the web no later than September 13, and you may withdraw from the course (with a grade of W) no later than November 5.

Institutional Classroom Attendance Policy: Please be aware that the university has implemented an attendance policy, which requires faculty to verify student participation in every class a student is registered at the start of each new semester/course. For this course, if you have not attended/participated in class (completed any course activities or assignments) within the first 14 days, I am required by federal law to report you as not attended. Unfortunately, not attending/participating in class impacts your eligibility to receive financial aid, so it is VERY important that you attend class and complete course work in these first two weeks. Please contact me as soon as possible to discuss options and/or possible accommodations if you have any difficulty completing assignments within the first two weeks. If you have read all the way to this point of the syllabus, good work and your attention to detail will be rewarded. E-mail me a picture of a dog from your rockets.utoledo.edu account with the subject extra credit dog and you will receive three points of extra credit to be added to your course final point total

Policy Statement on Non-Discrimination because of Disability (ADA): The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance](#). Students can find this policy along with other university policies listed by audience on the [University Policy webpage](http://www.utoledo.edu/policies/audience.html/#students) (<http://www.utoledo.edu/policies/audience.html/#students>).

Academic Accommodations: The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an Accommodations Memo from the Office of Accessibility and Disability Resources, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established accommodations with the Office of Accessibility and Disability Resources and are experiencing disability access barriers or are interested in a referral to health care resources for a potential disability, please connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

ACADEMIC AND SUPPORT SERVICES

Please follow this link to view a comprehensive list of [Student Academic and Support Services](#) available to you as a student.

SAFETY AND HEALTH SERVICES FOR UT STUDENTS

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

INCLUSIVE CLASSROOM STATEMENT

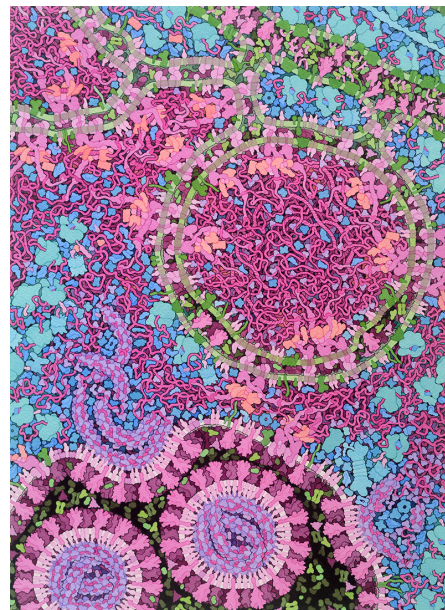
In this class, we will work together to develop a learning community that is inclusive and respectful. Our diversity may be reflected by differences in race, culture, age, religion, sexual orientation, gender identity/expression, socioeconomic background, and a myriad of other social identities and life experiences. We will encourage and appreciate expressions of different ideas, opinions, and beliefs so that conversations and interactions that could potentially be divisive turn, instead, into opportunities for intellectual and personal development.

BIOCHEMISTRY I

SPECIAL COURSE EXPECTATIONS DURING COVID-19

Maintaining a safe campus during the ongoing COVID-19 pandemic remains a top priority. UToledo continues to follow the guidance of the U.S. Centers for Disease Control and Prevention and Ohio Department of Health to keep our campus safe.

Attendance: The University of Toledo has a missed class policy. It is important that students and instructors discuss attendance requirements for the course. Before coming to campus each day, students should take their temperature and complete a self-assessment for symptoms of COVID-19, such as cough, chills, fatigue, or shortness of breath. Anyone with a temperature at or above 100.0 degrees Fahrenheit or who is experiencing symptoms consistent with COVID-19 should not come to campus and contact their primary care physician or the University Health Center at 419.530.5549. For more information on the symptoms of COVID-19, please go to <https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html>. COVID-19 testing for sick students is available on both Main Campus and Health Science Campus. Call 419.383.4545 for an appointment. Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences. Students should notify their instructors and follow the protocols summarized in this document on [Navigating COVID-Related Course Concerns](#). In the event that you have tested positive for COVID-19 or have been diagnosed as a probable case, please review the [CDC guidance](#) on self-isolation and symptom monitoring, and report the disclosure to the Division of Student Affairs by emailing StudentAffairs@utoledo.edu or by connecting with their on-call representative at 419.343.9946. Disclosure is voluntary and will only be shared on a need-to-know basis with staff such as in the Office of Student Advocacy and Support, The Office of Residence Life, and/or the Office of Accessibility and Disability Resources to coordinate supportive measures and meet contact tracing requirements.



Face coverings: Face coverings are required while on campus, except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason preventing you from wearing a face covering due to a health condition deemed high-risk by the CDC, submit an [online application](#) to request an accommodation through the Office of Accessibility and Disability Resources. Students will need to provide documentation that verifies their health condition or disability and supports the need for accommodations. Students already affiliated with the Office of Accessibility and Disability Resources who would like to request additional accommodations due to the impact of COVID-19, should contact their accessibility specialist to discuss their specific needs. You may connect with the office by calling 419.530.4981 or sending an email to StudentDisability@utoledo.edu.

Vaccination: Doctors and other health care professionals agree that the best way to protect ourselves and each other is to get vaccinated. Case data clearly show that vaccines remain highly effective at preventing serious illness from COVID, including the highly contagious delta variant. If you have not yet received your COVID vaccine, the University encourages you do so as soon as possible. No appointment is needed to get the shot at the UTM Outpatient Pharmacy, University Health Clinic or Main Campus Pharmacy. Once you receive the COVID vaccination, please register on the COVID Vaccine Registry site at: <https://utvaccinereg.utoledo.edu/>.

Special Note: Based on the unpredictability of the COVID-19 virus, things can change at any time. So please be patient and understanding as we move through the semester. I also ask that you keep me informed of concerns you may have about class, completing course work/assignments timely and/or health concerns related to COVID.

BIOCHEMISTRY I

COURSE SCHEDULE

Week	Date	Class	Reading	Student Learning Objective(s)	Assessments
1	30-Aug-21	Lec 1: The meaning of life	1.1-1.5	2, 3, 11	
	1-Sep-21	Lec 2: The molecules and mechanisms of life			
	3-Sep-21	Lec 3: Energy, entropy, and complexity			
2	6-Sep-21	Labor Day – No Class	2.2-2.5	2, 3, 4, 5, 11	
	8-Sep-21	Lec 4: Intermolecular forces; water and the hydrophobic effect			PS 1 Wed 11:59 pm
	10-Sep-21	Lec 5: Ionization and buffers			
3	13-Sep-21	Lec 6: Intro to carbohydrates; glucose, monosaccharides	7.1-7.4 10.1	1, 2, 3	Last day to drop
	15-Sep-21	Lec 7: Disaccharides, oligosaccharides, polysaccharides, glycoconjugates			PS 2 Wed 11:59 PM
	17-Sep-21	Lec 8: Intro to lipids, fatty acids, triacylglycerols			Quiz 1
4	20-Sep-21	Lec 9: Glycerophospholipids and sphingolipids	10.2-10.4 8.1, 8.4	1, 2, 3	
	22-Sep-21	Lec 10: Isoprenoids and polyketides			PS 3 Wed 11:59 PM
	24-Sep-21	Lec 11: Nucleotides			
5	27-Sep-21	Lec 12: Amino acids	3.1-3.4	1, 2, 3, 5, 6	
	29-Sep-21	Lec 13: Peptide bonds and protein primary structure			PS 4 Wed 11:59 PM
	1-Oct-21	Lec 14: Protein secondary structure			Quiz 2
6	4-Oct-21	Lec 15: Protein tertiary and quaternary structure	4.1-4.5 5.1	2, 3, 8	
	6-Oct-21	Lec 16: Protein folding and denaturation			PS 5 Wed 11:59 PM
	8-Oct-21	Lec 17: Protein-ligand binding			
7	11-Oct-21	Lec 18: Catalysis by enzymes	6.1	2, 3, 7	
	13-Oct-21	Midterm Exam (Lec 1-16, Ch 1, 2, 3, 4, 7, 8.1-8.4, 10)			Midterm Exam
	15-Oct-21	Fall Break – No Class			
8	18-Oct-21	Lec 19: Enzyme kinetics	6.2-6.4	2, 3, 7, 8, 9	
	20-Oct-21	Lec 20: Enzyme inhibition			PS 6 Wed 11:59 PM
	22-Oct-21	Lec 21: Enzyme mechanisms			
9	25-Oct-21	Lec 22: Enzyme mechanisms 2	6.4-6.5	2, 3, 7, 8, 9	
	27-Oct-21	Lec 23: Enzyme inhibitors as drugs			PS 7 Wed 11:59 PM
	29-Oct-21	Lec 24: Regulation of enzyme activity			Quiz 3
10	1-Nov-21	Lec 25: Molecular physiology – muscle contraction	5.1-5.3	2, 3, 8, 10, 11	
	3-Nov-21	Lec 26: Molecular physiology- O ₂ binding/transport I			PS 8 Wed 11:59 PM
	5-Nov-21	Lec 27: Molecular physiology- O ₂ binding/transport II			Last day to withdraw
11	8-Nov-21	Lec 28: Nucleic acid primary structure	8.2-8.3	2, 3, 6, 11	
	10-Nov-21	Lec 29: Nucleic acid three-dimensional structure			PS 9 Wed 11:59 PM
	12-Nov-21	Lec 30: Overview of information metabolism, viruses			Quiz 4
12	15-Nov-21	Lec 31: Recombinant DNA technology	9.1-9.3 11.1-11.3	2, 3, 6, 10, 11	
	17-Nov-21	Lec 32: Biological membranes			PS 10 Wed 11:59 PM
	19-Nov-21	Lec 33: Membrane transport: Overview and facilitated diffusion			
13	22-Nov-21	Lec 34: Membrane transport: Active transport	11.3	2, 3, 10, 11	
	24-Nov-21	Thanksgiving Break – No Class			
	26-Nov-21	Thanksgiving Break – No Class			
14	29-Nov-21	Lec 35: Membrane transport: Channels, action potentials	11.3 12.1-12.2	2, 3, 10, 11	
	1-Dec-21	Lec 36: Introduction to signal transduction			PS 11 Wed 11:59 PM
	3-Dec-21	Lec 37: G-protein coupled receptor signaling			Quiz 5
15	6-Dec-21	Lec 38: Receptor tyrosine kinase signaling	12.3-12.9	2, 3, 10, 11	
	8-Dec-21	Lec 39: Ion channels and neurotransmission			
	10-Dec-21	Lec 40: Sensory signal transduction			PS 12 Fri 11:59 pm
	13-Dec-21	Final Exam (Lec 1-40, Ch. 1-12) 10:15 am-12:15 pm			Final Exam



BIOCHEMISTRY I

Syllabus Artwork credits (all original images are available at the RCSB Protein Data Bank, www.rcsb.org)

p. 1: *Trypsin*, 1974. Illustration by Irving Geis. Geis Digital Archive, <https://pdb101.rcsb.org/sci-art/geis-archive/gallery/geis-0022-trypsin>

p. 2: *Hemoglobin*, 1978. Illustration by Irving Geis. Geis Digital Archive, <https://pdb101.rcsb.org/sci-art/geis-archive/gallery/rcsb-0006-hemoglobin>

p. 3: *Deoxyribonucleic acid*, 1983. Illustration by Irving Geis. Geis Digital Archive, <https://pdb101.rcsb.org/sci-art/geis-archive/gallery/geis-0394-dna>

p. 4: *SARS-CoV-2 mRNA Vaccine*, 2020. Illustration by David S. Goodsell, RCSB Protein Data Bank; doi: 10.2210/rcsb_pdb/goodsell-gallery-027

p. 6: *Lysozyme*, 1966. Illustration by Irving Geis. Geis Digital Archive, <https://pdb101.rcsb.org/sci-art/geis-archive/gallery/geis-0488-lysozyme>

p. 8: *Coronavirus Life Cycle*, 2020. Illustration by David S. Goodsell, RCSB Protein Data Bank; doi: 10.2210/rcsb_pdb/goodsell-gallery-023