

## BIOCHEMISTRY 56100 General Biochemistry

Online

3- credit hours

Prerequisites:

You are expected to have a basic understanding of organic chemistry and must have a minimum grade of C- in one of the following courses (or an equivalent course from other institutions): CHM 25600, CHM 25700, CHM 26200, CHM 26605, MCMP 20500, CHEM C3420. If you have any concerns about your preparation for BCHM 561, please contact the instructor as soon as possible.

### INSTRUCTOR

Sandra Rossie, Professor of Biochemistry

**E-mail:** [rossie@purdue.edu](mailto:rossie@purdue.edu)

**Office hours:** to be determined

### TEACHING ASSISTANT

Andrew DeMarco

**E-mail:** [demarco0@purdue.edu](mailto:demarco0@purdue.edu)

**Office hours:** to be determined

## Course Description

The major goal of 561 is to understand the basic biochemical properties of proteins and nucleic acids. A key theme for the course is to understand the relationship between structure and function in biomolecules. We will first review basic chemical concepts and how these explain the behavior of macromolecules. We will then discuss protein structure. Proteins mediate virtually every process that takes place in the cell and we want to understand how these macromolecules do this remarkable job. We will spend considerable time learning about the biochemical properties of proteins so we can understand how they can perform so many vital functions in the cell. In this endeavor, it will be important to thoroughly understand the structure and chemical properties of the amino acids that are the monomeric units of the protein polymers. We will also discuss how proteins are analyzed.

Next we will consider DNA, RNA and the flow of genetic information. We will learn the structure and properties of the nucleotides, which are monomers that are linked together to make the DNA and RNA polymers of the cell. DNA carries the precious genetic information that specifies, to a large degree, who we are and what we look like. Our DNA carries the information used to build proteins. We will briefly examine the basic mechanisms used to transfer the information carried in the sequence of our DNA to the molecular machinery that assembles the proteins of the cell. These processes are commonly referred to as the central dogma.

Despite being built from only 20 amino acids, proteins exhibit tremendous diversity. We will use hemoglobin as a model for thinking about the basic properties and function of proteins.

Then, we will study enzyme kinetics and the mechanisms by which enzymes catalyze biochemical reactions. Another important objective is to learn how enzymes are regulated. Examining the properties of carbohydrates and lipids is also a goal of this course. We will learn how lipids form membranes and how proteins move substances across the membrane.

## Learning Outcomes

BCHM 561 students will understand the molecular principles of life based on the core disciplines of biology, chemistry and physics. Students will:

1. Describe the chemical structures of the building blocks of biological macromolecules, including amino acids, nucleotides, sugars and fatty acids, and explain how they form the higher order structures of proteins, nucleic acids and polysaccharides.
2. Interpret and apply the thermodynamic principles underlying chemical reactions and formation of complex structures.
3. Interpret and apply the principles of enzyme catalysis and regulation.
4. Explain how genetic information is encoded and transferred in biological organisms.
5. Describe membrane structure and function.
6. Explain and apply the principles of molecular biology and protein analysis.

## How to Succeed in this Course

### SUGGESTIONS FOR STUDYING BIOCHEMISTRY

This course covers a large amount of detailed material. It is very important to read the chapters and study the notes and text on a regular basis. Do not allow yourself to fall behind and then find it necessary to cram just before exams. If you have questions or need assistance, please contact the TA or me as soon as possible. Please do not wait until the last minute to seek help.

### READING & STUDYING

I highly recommend the following strategy for approaching this course:

1. Read the assigned text
2. Watch the associated lecture(s) and take your own notes. Also note concepts or comments in the lecture that you did not understand. If you do not resolve your questions during your studying, ask questions on the *Discussion board*.
3. Write out answers to the relevant learning objectives, then compare your answers to descriptions in the book.
4. Test yourself using relevant problem sets. Where to find these? Some I will provide as short, non-graded questions. Additional problems are in the back of each chapter and available on the internet.

***These last two steps (3 and 4) are critical.*** The most important thing you can do is to perform some type of self-assessment as you conduct your studies to find out what you do and do not understand. At times there will be structures that must be learned like a basic vocabulary in order to understand the properties of biological polymers. This can be approached as a mindless memorization project or can be addressed in an alternative and more compelling manner in which you learn structures at least in part by using them in your studies.

#### **GENERAL TIPS FOR SUCCESS**

Whether this is your first semester here at Purdue or you have already taken several courses at the university level, succeeding in a university course will often involve:

- Scheduling time each week for working on this course, outside of class times.
- Following the course schedule, rather than trying to work ahead on your own.
- Reaching out to the instructor and TA with any questions, as early as possible.

By following each of the above tips, you will be able to make the most of this course.

## **Learning Resources, Technology, & Texts**

### **TEXTBOOK** (Required)

Berg, J. M., Tymoczko, T, L, Gatto, G. J. Jr., and Stryer, L. Biochemistry  
9<sup>th</sup> Edition (2019) (W. H. Freeman & Co.) ISBN-10: 1-319-11467-9; ISBN-13: 978-1-319-11467-1

*OR*

8<sup>th</sup> Edition (2015) (W. H. Freeman & Co.) ISBN-10: 1-4641-2610-0; ISBN-13: 978-1-4641-2610-9

E-editions with electronic problems, support, etc. are also available E-editions with electronic problems, support, etc. are also available

<https://store.macmillanlearning.com/us/product/Biochemistry/p/1319114679>

- We will read approximately two chapters of the textbook each week (following the schedule below), and quizzes and exams will be based on reading from the textbook.

### **TECHNOLOGY REQUIREMENTS**

- **INTERNET**
- You will need a reliable Internet connection on a daily basis to meet the requirements for this class. A consistent minimum speed of 20 Mbps download and 5-10 Mbps upload speed is required. Poor connectivity will not be accepted as an excuse for not reviewing content, or missing assessment deadlines. Your instructor and TA will be not able to troubleshoot any internet connectivity issues for you.
- **COMPUTER & SOFTWARE**
- A computer equipped with a webcam is required to take this course. *A tablet such as an iPad or a mobile phone will not be sufficient.* You will use Respondus Lockdown Browser and Respondus Monitor for exams. You must be able to download and use these software programs on the computer you use for this course. Instructions will be provided on Brightspace describing how to use

this software. Neither I nor your TA, will be able to troubleshoot any computer or software issues for you. You may contact ITaP, or the Academic Success Center for help.

### **BRIGHTSPACE PAGE**

You can access the course via [Brightspace website](#). It is strongly suggested that you explore and become familiar not only with the site navigation, but with content and resources available for this course. The syllabus, lecture notes, course announcements, and any assignments will be posted on there for the course. You must be able to use Brightspace and all of its features to be successful in this course. If you need help with Brightspace, please consult Student Help and Success (shown in left side menu).

## **Course Logistics**

- Weeks will run from Monday to Sunday. I will post information (online activities, discussion starters, etc.) for the upcoming week by Sunday evening, so that when you log in on Monday, you can begin the new week.
- All assignments are due by 11:30pm. EST on the due date listed in the course schedule.
- Course requirements must be completed and posted or submitted on or before the specified due date. Due dates are defined as Eastern Standard Time (as used in West Lafayette, Indiana). To encourage you to stay on schedule, due dates have been established for each assignment; 20% of the total points will be deducted for assignments received 1-6 days late; assignments received more than 1 week late will receive 0 points.
- An assignment file should be appended by your username, such as "assignment1-kim53.doc". This will make it easier for me to manage assignment files.

## **Instructor's Office Hours**

Due to Covid 19 issues, I will limit my on-campus meetings. Please email me if you wish to meet in person. Virtual Office Hours are a synchronous session (through WebEx) to discuss questions related to assignments. Office hours will be held Wednesday afternoon from 2:30-3:30pm EST. *I will conduct a poll to learn if students are in different time zones and if I should hold another office hour at a time that works better for different time zones.* I will post information on the virtual meeting location on BS.

## **Instructor's Email Availability and Policies**

I am generally available via email daily and try to respond within 24-48 hours. When emailing me, please place the course number and the topic in the subject line of the email (*e.g.*, XXX 240 – Assignment 2 Question). This will help me tremendously in locating and responding to your emails quickly. *Please direct biochemistry questions to the Discussion board, where they will be answered for the whole class on a regular basis by the TA.*

The TA will also hold office hours to answer questions that you post on the course Discussion board three office hours a week, which he also will arrange after polling students. If needed, we also can arrange for a Webex review session before exams; during these review sessions the TA. will answer specific questions but will not provide a general review session for you.

## Assignments and Points

Your learning will be assessed through a combination of quizzes, exams, team-based case studies following each chapter and one research /presentation project, and a short review paper focused on a protein of your choice. Details on quizzes and exams, and all other assignments will be posted on the course website.

**Exams-** There will be four exams, with the final exam taking place during finals week. Each exam will cover 3-4 chapters apiece and be worth 100 points. These are closed book timed exams that will be administered using Respondus Lockdown and monitor software. You will have a 24-hour window within which they must be completed. You must take them in a suitable well-lit environment, with no one else in the room, and do an environment scan with your webcam before starting to demonstrate that you have no materials (including your phone) on your desk. You must also provide an id and a non-electric calculator for your exam. You will be permitted one sheet of blank paper for calculations per exam, which you should also scan prior to the exam.

**Quizzes-** There will be five quizzes worth 25 points apiece. These will be closed book timed quizzes that will be administered using Respondus Lockdown and monitor software. The lowest score will be dropped. You will have a 24-hour period within which you must complete the quiz. Once you begin the quiz, you must complete it; you cannot stop and start. You must also provide an id and a non-electric calculator for your exam. You will be permitted one sheet of blank paper for calculations per exam, which you should also scan prior to the exam.

**TEAM projects-** There will be 2 sets of projects for which you will work in teams. One is a weekly chapter discussion in which you will review and answer a set of questions based on a clinical problem related to each chapter. The second project, the Covid 19 team project, is a one-time project in which you break into teams to investigate various topics related to Covid 19, then return to your regular discussion group and teach everyone in that group what you have learned. These two projects are described a little further below.

**Chapter discussion and questions-**After each chapter you will read a clinical case study and answer a set of biochemistry questions, then meet with your discussion group and discuss everyone's answers, then summarize and submit your best collective answers. Detailed information on this project will be provided on Brightspace.

**Covid 19 team project-** Everyone in your initial discussion group will choose a different Covid 19 topic to research. You will then join together with people from other discussion groups who are researching this topic (this will be your Topic team) and put together a report on your topic. Each of you will then return to your original discussion group and teach them about your topic. Your report should be based on research literature and limited amount of news releases or popular literature. Detailed information on this project will be provided on Brightspace.

**Protein paper-** Each student will write a short review on a protein of their choice (3 pages typed). This paper will summarize the significance of the protein, what is known about the structural basis for its function, what, if anything has been learned from natural or artificial mutations or gene manipulations. If (natural or synthetic) activators or inhibitors are known, the role and mechanism of these should also be discussed. This paper is due at the end of the semester.

**Extra Credit-** After each lecture video, a series of chapter learning outcomes and suggested study questions are provided. These will not be graded and are for study purpose only. BUT, if a student completes all the answers to these questions and learning outcomes and provides them on a

weekly basis, they can receive 20 extra credit points. The answers will NOT be graded, and feedback will only be given if the student asks for help with the material.

Another opportunity for 5 extra credit points is available if you provide a summary of every Nobel Prize winner whose idea is presented in the chapters we cover. You should include the prize, year, person or persons, and a 1-paragraph summary in your own words on what the prize was won for and why the concept or new technology is so important. You must include ALL the Nobel prizes to get credit. The purpose of this extra credit assignment is to provide an additional writing exercise that is fun and interesting, so resist the impulse to copy words from the internet and *push yourself to write*.

At the end of the course there will be an end-of-course review. If over 80% of the students respond to this review, everyone in the class will receive 5 extra credit points.

### Grading Scheme

Exam 1	100 points
Exam 2	100 points
Exam 3	100 points
Exam 4 (Final non-cumulative)	100 points
Quizzes 25 points apiece (x5, drop 1)	100 points
Chapter Discussion questions	100 points
Short paper on a protein of your choice	60 points
Covid 19 Case study (Group project)(points per student)	60 points
Extra credit (non-graded questions) <sup>§</sup>	15 points
End of course survey Extra credit*	5 points
Total	720 points`

### Missed or Late Work

Missing an exam or quiz will result in a “zero” being recorded unless documented justification for the absence is presented. **You will have a minimum of a 24 hour-window to complete all assessments, therefore, no rescheduling of quizzes or exams will be permitted for any reason.** Poor internet connection, falling asleep before the submission deadline, etc., will not be accepted as a reason for late submissions of assessments.

### Grading Scale

GRADE	% OF TOTAL POINTS
A	90-100

B	80-89
C	70-79
D	60-69
F	<59

## Incompletes

A grade of incomplete (I) will be given only in unusual circumstances. To receive an “I” grade, a written request must be submitted prior to August 1, and approved by the instructor. The request must describe the circumstances, along with a proposed timeline for completing the course work. Submitting a request does not ensure that an incomplete grade will be granted. If granted, you will be required to fill out and sign an “Incomplete Contract” form that will be turned in with the course grades. Any requests made after the course is completed will not be considered for an incomplete grade.

## Course Schedule

The course schedule, including dates for assignments, quizzes and exams, is provided on a separate page.

## Academic Integrity

Academic misconduct will not be tolerated in this course. It is particularly important to understand that the pursuit of scientific knowledge requires that all involved in this endeavor exhibit high integrity and adhere to the highest ethical and intellectual standards. It is crucial for those of you earning degrees in scientific fields to follow the high standards of ethical conduct expected of scientists.

Information on Purdue’s policies with regard to academic misconduct can be found at: [http://www.purdue.edu/studentregulations/student\\_conduct/regulations.html](http://www.purdue.edu/studentregulations/student_conduct/regulations.html)

Any incidence of academic misconduct will be reported to the Office of the Dean of Students. Academic misconduct may result in disciplinary sanctions including expulsion, suspension, probated suspension, disciplinary probation, and/or educational sanctions. In addition, such misconduct will result in punitive grading such as earning a lower or *failing grade* on an exam or assignment or receiving a lower or *failing grade* for the course.

The following text on academic misconduct is taken from the University “*Regulations Governing Student Conduct, Disciplinary Proceedings, and Appeals*” found at the [website given above](#):

*“Dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty. The commitment of the acts of cheating, lying, stealing, and deceit in any of their diverse forms (such as the use of ghost-written papers, the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) are dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing*

*dishonest acts is in itself dishonest. (University Senate Document 72-18, December 15, 1972)."*

As requested by The Honor Pledge Task Force, a student organization responsible for stewarding the mission of the Honor Pledge and encouraging a culture of academic integrity, the students' honor code is also shared here:

The [Purdue Honor Pledge](#) "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

## **USE OF COPYRIGHTED MATERIAL**

You are not permitted to distribute course material given to you in class, via email or brightspace, etc., to any other entity. Among the materials protected by copyright law are the **lectures, notes, and other material presented in class or as part of the course**. Always assume the materials presented by the instructor are protected by copyright unless stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern.

## **Nondiscrimination Statement**

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. [Link to Purdue's nondiscrimination policy statement](#)

## **Academic Guidance in the Event a Student is Quarantined/Isolated**

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at [acmq@purdue.edu](mailto:acmq@purdue.edu) and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students ([odos@purdue.edu](mailto:odos@purdue.edu)) is also available to support you should this situation occur.

## Students with Disabilities

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247.

*Purdue has assistance available to help you make learning materials accessible. Some examples include:*

- Information on [Universal Design for Learning](#)
- Guidance on [creating accessible documents](#)

## Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

*Guidelines regarding ensuring access to emergency information:*

- *Keep your cell phone on to receive a Purdue ALERT text message.*
- *Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.*
- *If you have a "no cell phone" in class policy allow one or two students who have signed up for Purdue ALERT to keep their phones on to receive any alerts*

## Mental Health Statement

- **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#).** Sign in and find information and tools at your fingertips, available to you at any time.
- **If you need support and information about options and resources,** please see the [Office of the Dean of Students](#) for drop-in hours (M-F, 8 am- 5 pm).
- **If you're struggling and need mental health services:** Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

## Netiquette

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea, but you are not to attack an individual. Our differences, some of which are outlined in the University's nondiscrimination statement below, will add richness to this learning experience.

Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an “open-mind” and be willing to express even your minority opinion.
- Think and edit before you push the “Send” button.
- Do not hesitate to ask for feedback.

## **Violent Behavior Policy**

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

## **Diversity and Inclusion Statement**

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker’s intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

## **Course Evaluation**

During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

## **Disclaimer**

Any changes or updates to the syllabus will be shared with students via announcements through Brightspace.



