



DEPARTMENT OF BIOCHEMISTRY

**BCHM 32200 – Analytical Biochemistry  
Syllabus  
Fall, 2021**

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Office hours: By appointment

**TIME AND PLACE**

Lecture: Thursday 9:30-10:20 AM, BCHM 112

Lab: Thursday 2:30-5:20 PM, BCHM 112

BCHM 32200 is primarily a laboratory course but there are also formal lectures. The class session in the morning designated as lecture period may be used for this purpose but will often be used to set up work for the afternoon lab period. In the case there is time for the instructor to give the lecture in class, you should review the lecture material online.

**COURSE OBJECTIVES**

The primary objectives of this course are to introduce students to both classical and modern biochemical methods for the isolation and analysis of biological molecules, with an emphasis on proteins. Principles and theory of techniques will be presented during lecture periods followed by application of the techniques during lab periods. Methods include affinity and size exclusion chromatography, electrophoresis, centrifugation, immunoblotting, spectrophotometry, mass spectrometry, bioinformatics, and structural modeling. Basic lab skills and concepts will be reinforced and use of the scientific method will be incorporated into the lab experiments. Students will learn scientific communication skills by writing a comprehensive final lab report.

## LEARNING OUTCOMES

BCHM 32200 students will understand the molecular principles of life based on the core disciplines of biology, chemistry, and physics.

BCHM 32200 students will be skilled laboratory scientists. They will perform a wide variety of biochemical and molecular techniques.

BCHM 32200 students will understand the scientific method. They will understand the concepts and importance of hypotheses, experimental design to test hypotheses, and data analysis in the creation of new knowledge.

BCHM 32200 students will acquire information literacy: the ability to locate, evaluate, and utilize information in the disciplines of biochemistry and molecular biology that is required for research, data analysis, and communication.

BCHM 32200 students will communicate scientific knowledge, experiments, and conclusions effectively as writers.

BCHM 32200 students will understand the contributions of our discipline to society, including improvements to medicine, agriculture, the economy, and the environment.

## TEXTBOOK AND COURSE MATERIAL

No textbook is required for this course. Lecture material will be posted to the course Brightspace page, and they are the primary learning resource. Reading material from various sources will also be provided via Brightspace.

Each week a PDF file containing instructions and information for the lab experiments will be posted to the course Brightspace page. **You are required to print this file and bring it with you to lab. You will need these instructions to conduct the experiments properly.** We are not allowed to print handouts for courses now. It is the student's responsibility to do this.

**Read the lab instructions ahead of time so that you are coming to lab prepared.**

**Molecular Operating Environment (MOE) Software** – The Department of Biochemistry has obtained teaching licenses for the MOE software, and we thank the Chemical Computing Group ([www.chemcomp.com](http://www.chemcomp.com)) for producing these licenses. The MOE software will be used for multiple computational modeling activities during the semester.

## BRIGHTSPACE

The course syllabus, lecture notes, lab instructions, extra reading material, and grading keys for exams will be available via the Purdue University Brightspace site at:

<https://purdue.brightspace.com/d2l/login>

## LAB SAFETY

Bring your own lab coat. Do not wear open-toe shoes (e.g., sandals) or shorts to the lecture and lab sessions. Please wear long pants. Food and drinks are not permitted in the teaching labs at any time. Read the lab safety guidelines provided in Brightspace.

## ASSESSMENT

The grading for this course will be as follows:

Exam 1	20%
Exam 2	20%
Pre-lab quizzes	10%
Lab data & question sheets	30%
Intermediate lab report	5%
Final lab report	15%

The cutoff values for letter grades are as follows:

92-100%	A
90-91%	A-
88-89%	B+
82-87%	B
80-81%	B-
78-79%	C+
72-77%	C
70-71%	C-
60-69%	D
Below 60%	F

If you have any disagreements with the way any of your exams or assignments have been graded, please consult the grading key and then discuss them with the teaching assistant. In the event this does not resolve your concerns, please take them up with the instructor.

Requests for re-grades must be submitted no later than the end of the second class period after the graded exam or lab report has been returned.

### **Exams:**

Two non-cumulative examinations are scheduled for the course. Missing an exam will result in a grade of 0 being recorded. Makeup exams will be scheduled in consultation with the instructor.

### **Lab Data and Question Sheets:**

Each week, your group should have all data collection and analyses completed and uploaded to your OneDrive folder. In addition, there will be a post-lab question sheet to turn in before the next class (by 11:59 PM on Wednesday in the following week). These question sheets involve interpretation of the data, and they must be completed independently, not as a group. If it is determined that you did not independently complete the data interpretation assignment, a zero grade will be entered for that particular assignment, and at the instructor's discretion may result in a failing grade for the course. At the end of the semester, the lowest question sheet score will be dropped.

We have tablets/laptops to use in the newly renovated teaching lab. All lab raw data and notes should be kept in OneDrive so that each of you can access to it outside of lab.

### **Final Lab Report:**

You will be required to write a manuscript-style lab report in the format of a biochemistry journal that describes the purification, identification, and characterization of your enzyme, including appropriate figures and tables to present your experimental results from throughout

the semester. Detailed instructions and grading rubrics are provided on Brightspace and will be discussed in class.

#### Due dates:

A draft of the research paper that counts 5% towards the final grade for the course will be due on October 21 (by 11:59 PM). Peer review and feedback on this draft will be provided. The final version of the paper, which counts 15% towards the final grade for the course, will be due on December 13 at 12 PM. No late submissions will be accepted.

### **EXTRA CREDIT**

Opportunities for extra credit, if any, will be announced in class.

### **OBTAINING EXTRA HELP**

Dr. Liu will be available to answer your questions immediately after class, during the lab period, or by appointment (arranged in class or by e-mail). Alternatively, you can submit questions by e-mail.

The lab TA will not hold office hours but will be available to answer questions by appointment (arranged in class or by e-mail). Alternatively, the lab TA will be available to answer questions by e-mail.

### **CLASS ATTENDANCE**

Attending every lecture and laboratory section is important for successful learning in this course. The lectures will discuss important lab techniques and their scientific basis, and the labs will provide hands-on experimental experience in a research setting. It is not practical to make up labs at other times. If an absence from lab is unavoidable, you should contact the teaching assistant or instructor. An absence without notifications (no show) will result in a score of 0 on the lab data & question sheets relevant to that week.

The student needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via [email](mailto:email) or phone at 765-494-1747.

### **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.

## PROTECT PURDUE PLAN

The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask in classrooms and lab at all times (e.g., no eating/drinking in the classroom), cleaning desk/workspace prior to and after use, and following all safety directions from the instructor.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#).

## ACADEMIC MISCONDUCT

Academic misconduct of any kind will not be tolerated in any course offered by the Department of Biochemistry. 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:

- receiving a lower or failing grade on the assignment, or
- assessing a lower or failing grade for the course

Punitive grading decisions will be made after consultation with the Office of the Dean of Students. Please note reported incidences of academic misconduct go on record for reference by other instructors. Further, a record of academic misconduct is likely to influence how current/future situations are handled.

To provide you with an unambiguous definition of academic misconduct, the following text has been excerpted from "Academic Integrity: A Guide for Students", written by Stephen Akers, Ph.D., Executive Associate Dean of Students (1995, Revised 1999, 2003), and published by the Office of the Dean of Students in cooperation with Purdue Student Government, Schleman Hall of Student Services, Room 207, 475 Stadium Mall Drive West Lafayette, IN 47907-2050.

“Purdue prohibits “dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty.” [Part 5, Section III-B-2-a, *Student Regulations*] Furthermore, the University Senate has stipulated that “the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is 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]

More specifically, the following are a few examples of academic dishonesty which have been discovered at Purdue University.

- substituting on an exam for another student
- substituting in a course for another student
- paying someone else to write a paper and submitting it as one's own work
- giving or receiving answers by use of signals during an exam
- copying with or without the other person's knowledge during an exam
- doing class assignments for someone else
- plagiarizing published material, class assignments, or lab reports
- turning in a paper that has been purchased from a commercial research firm or obtained from the internet
- padding items of a bibliography
- obtaining an unauthorized copy of a test in advance of its scheduled administration
- using unauthorized notes during an exam
- collaborating with other students on assignments when it is not allowed
- obtaining a test from the exam site, completing and submitting it later
- altering answers on a scored test and submitting it for a regrade
- accessing and altering grade records
- stealing class assignments from other students and submitting them as one's own
- fabricating data
- destroying or stealing the work of other students

Plagiarism is a special kind of academic dishonesty in which one person steals another person's ideas or words and falsely presents them as the plagiarist's own product. This is most likely to occur in the following ways:

- using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
- presenting the sequence of ideas or arranging the material of someone else even though such is expressed in one's own words, without giving appropriate acknowledgment
- submitting a document written by someone else but representing it as one's own”

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing [integrity@purdue.edu](mailto:integrity@purdue.edu) or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

Purdue's Honor Pledge was developed by students to advance a supportive environment that promotes academic integrity and excellence. It is intended that this pledge inspires

Boilermakers of all generations to stay "on track" to themselves and their University. "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

## **NOTICE OF COPYRIGHT PROTECTION OF COURSE MATERIALS**

Among the materials that may be 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 an instructor are protected by copyright unless the instructor has 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, however, generally 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, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

## **EMERGENCY PREPAREDNESS**

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.

## **ON-LINE COURSE EVALUATIONS**

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

## **NON-DISCRIMINATION POLICY**

Purdue University's non-discrimination policy will be upheld in this classroom. 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.

Purdue University views, evaluates, and treats all persons in any University related activity or circumstance in which they may be involved, solely as individuals on the basis of their own personal abilities, qualifications, and other relevant characteristics.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs and values expressed by students and staff involved in this course. We support Purdue's commitment to diversity, and welcome individuals of all ages, backgrounds, citizenships, disability, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences

For more information, see [http://www.purdue.edu/purdue/ea\\_eou\\_statement.html](http://www.purdue.edu/purdue/ea_eou_statement.html).

## **MENTAL HEALTH**

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 support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765) 494-6995 or <http://www.purdue.edu/caps/> after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

## **ACCESSIBILITY AND ACCOMODATIONS**

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.

## **DISCLAIMER**

This syllabus is subject to change.

## COURSE SCHEDULE

Week	Date	Lecture Topic	Lab Exercises
1	Aug 26	Course overview; Bioinformatics, evolutionary relationships between proteins	Using bioinformatics tools (homology searching, multi-sequence alignments, etc.)
2	Sep 2	Structure-function analysis of proteins	Site-directed mutagenesis
3	Sep 9	Recombinant protein expression	Recombinant protein expression
4	Sep 16	Chromatography, protein purification	Affinity purification of proteins
5	Sep 23	Electrophoresis	Protein analysis by SDS-PAGE, measuring protein concentration
6	Sep 30	Use of antibodies in biochemical research	Quantitative Western blotting
7	Oct 7	Analysis of proteins by mass spectrometry	Protein identification using mass spectrometry; MOE tutorial
8	Oct 14	Spectroscopic methods for protein analysis	<b>Exam 1.</b> Homology-based structural modeling (using MOE)
9	Oct 21	Intro to enzyme catalysis and regulation	Enzyme assays
10	Oct 28	Studying protein hydrodynamic properties	Determining protein oligomeric state by measurement of hydrodynamic properties
11	Nov 4	Enzyme kinetics	Michaelis-Menten enzyme kinetics
12	Nov 11	Molecular interactions and substrate specificity	Substrate specificity
13	Nov 18	Enzyme kinetics and enzyme inhibition	Enzyme inhibition
<b>Thanksgiving Break</b>			
14	Dec 2	Determining protein structure	Ligand docking and optimization for drug discovery (using MOE software)
15	Dec 9	<b>Exam 2</b>	