



DEPARTMENT OF BIOCHEMISTRY

**BCHM 32200 – Analytical Biochemistry  
Syllabus  
Spring, 2019**

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Office hours: By appointment

**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

There is no textbook for this course. Reading material from various sources will be provided to you via Blackboard or the internet.

Each week a PDF file containing instructions and information for the lab experiments will be posted to the course Blackboard 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.

**You MUST read the lab instructions prior to class. A short quiz will be given each week at the beginning of the morning lecture period on the lab instructions.**

**Molecular Operating Environment (MOE) Software** – Chemical Computing Group has very generously provided teaching licenses for their Molecular Operating Environment software free of charge for use in this course. The MOE software will be used for all computational modeling activities during the semester.

## TIME AND PLACE

Lecture: Thursday 10:30-11:20 AM, BCHM 112 OR Friday 11:30-12:20 PM

Lab: Thursday 1:30-4:20 PM, BCHM 112 OR Friday 1:30-4:20 PM

We do not have many formal lectures. The morning "lecture" period is often used to set up work for the afternoon lab period. Lecture material is presented online. Therefore, you should consider the morning lecture periods as part of the lab.

### **Attendance Policy:**

Attendance is mandatory every week. It is not practical to make up labs at other times. In the event that an absence from lab is unavoidable (e.g. if you have a University-sponsored activity, religious observances, illness, or family emergency), you must notify the instructor and he or the TA will assist you in obtaining information and materials you may have missed. At the discretion of the instructor you may be able to make up the laboratory by submitting a short (5 typewritten pages) paper discussing the subject of that lab exercise.

***Unexcused lab or lecture absences will result in a score of 0 on that week's pre-lab quiz and/or the lab question set relevant to that week.*** In addition, students who skip class without a valid excuse should not expect the instructor or TA to supply class notes or provide special help. Additional information on official university attendance policy see the following:

[http://www.purdue.edu/studentregulations/regulations\\_procedures/classes.html](http://www.purdue.edu/studentregulations/regulations_procedures/classes.html)

## BLACKBOARD

The course syllabus, lecture notes, lab instructions, extra reading material, and grading keys for quizzes and exams will be available via the Purdue University Blackboard Learn site at: <https://mycourses.purdue.edu/>

## LAB SAFETY

See attachment at the end of the syllabus for lab safety guidelines.

## ASSESSMENT

The two exams are non-cumulative. They will focus on the theory behind the methods learned and not on the lab exercises themselves. They will consist of multiple choice and short answer questions.

The grading for this course will be as follows:

Exam 1	20%
Exam 2	20%
Pre-lab and lecture quizzes	10%
Lab data & question sheets	30%
Final lab report	20%

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

Missing an exam or failure to turn in the lab report or lab question sheets on time will result in a grade of 0 being recorded unless documented justification is presented. Any request to be excused from an exam must include official documentation (doctor's note, request from academic advisor, etc) explaining why the exam was or will be missed. Makeup tests will be scheduled in consultation with the instructor.

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 TA. 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.

### Lab Data and Question Sheets:

Each week, your group should have all data collection and analyses completed and uploaded to your Blackboard Learn group folder. In addition, there will be a sheet of data

interpretation questions to turn in the following week at the beginning of the morning lecture period (11:30 AM). These should be completed independently, not as a group. You will receive a grade each week based on your group's data and on the individual answers to data interpretation questions. 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.

We have Surface Pro tablets to use in the newly renovated teaching lab. All lab notebooks should be kept in OneNote and a copy saved in Blackboard Learn so that you have access to it outside of lab.

### **Final Paper:**

Instead of a final exam for this course, you will be required to write a manuscript-style lab report in the format of a real 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.

Required sections include:

1. Title page - title of lab project, your name and your lab partners' names.
2. Introduction - Briefly describe background information related to the project and state the overall goal of the project. This section should be 1-2 pages, double-spaced.
3. Methods - Describe the procedures used to conduct the experiments in sufficient detail so someone with the appropriate knowledge and skill could use your report to repeat the experiment. There is no length restriction for this section – use as much space as needed.
4. Results – Present, in an organized manner, the most important data acquired during the semester. This section should consist of graphic objects illustrating the results (graphs, photos, tables, etc) and text describing these results, in the form of a “story”. This section should be on the order of ~10 pages, double-spaced, although the length is not as important as the clarity and organization of the content.
5. Discussion – provide a concise discussion of the results you obtained during the project. Specifically, address whether or not data supported your hypotheses. Speculate why unexpected results might have been observed and suggest explanations for why any experiments didn't work as expected. Give your interpretations as to the quality of the data obtained and what you learned/discovered from the experiments. This section should be roughly 1-2 pages, double-spaced, although the length is not nearly as important as the content.

More details will be provided during the semester. The final paper will be due during final exam week.

### **EXTRA CREDIT**

There are no official opportunities for extra credit.

## OBTAINING EXTRA HELP

Dr. Gimble 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 or by e-mail.

## ACADEMIC MISCONDUCT

Purdue University asks its students to adhere to the Purdue Honors Pledge:  
"As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue."

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/usp/acad\\_policies/student\\_code.shtml](http://www.purdue.edu/usp/acad_policies/student_code.shtml).

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, [University 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 breeches 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 University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in ([http://www.purdue.edu/purdue/ea\\_eou\\_statement.html](http://www.purdue.edu/purdue/ea_eou_statement.html)) which provides specific contractual rights and remedies.*

**Anti-Harassment Policy** -- Strictly following and interpreting existing University Policy: *Purdue University is committed to maintaining an environment that recognizes the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding and mutual respect; and encourages its members to strive to reach their potential. The most effective way to work toward preventing Harassment is through education that emphasizes respect for every individual.*

*Harassment in the workplace or the educational environment is unacceptable conduct and will not be tolerated. Purdue University is committed to maintaining an educational and work climate for faculty, staff and students that is positive and free from all forms of Harassment. This policy addresses Harassment in all forms, including Harassment toward individuals with legally protected status for reasons of race, gender, religion, color, age, national origin or ancestry, genetic information or disability and Harassment toward individuals for other reasons such as sexual orientation, gender identity, gender expression, marital status or parental status. The University will not tolerate Harassment of its faculty, staff or students by persons conducting business with or visiting the University, even though such persons are not directly affiliated with the University.*

***Purdue Anti-Harassment Policy***

**(III.C.1):** <http://www.purdue.edu/policies/ethics/iic1.html>

**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. To get information about changes in this course consult the class Blackboard site or e-mail or phone the instructor.

See document at end of syllabus for more emergency procedures information from Purdue. Please use this website as well for complete information on Purdue's emergency procedures and guidelines:

[http://www.purdue.edu/ehps/emergency\\_preparedness/index.html](http://www.purdue.edu/ehps/emergency_preparedness/index.html)

**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.

## LECTURE/LAB TOPIC SCHEDULE

Week	Date	Lecture Topic	Lab Exercises
1	Jan 10/11	Course overview; Bioinformatics, evolutionary relationships between proteins	Using bioinformatics tools (homology searching, multi-sequence alignments, etc.)
2	Jan 17/18	Studying enzyme structure and function	Site-directed mutagenesis
3	Jan 24/25*	Recombinant protein expression	Recombinant protein expression
4	Jan 31 Feb 1*	Chromatography, protein purification	Affinity purification of proteins
5	Feb 7/8*	Electrophoresis and other protein separation methods	Protein analysis by SDS-PAGE, measuring protein concentration
6	Feb 14/15*	Use of antibodies in biochemical research	Quantitative Western blotting
7	Feb 21/22*	Analysis of proteins by mass spectrometry	Protein identification using mass spectrometry; Homology-based structural modeling
8	Feb 28 Mar 1*	Spectroscopic methods for protein analysis	<b>Exam 1 LILY 3118 8:00-9:30 PM</b>
9	Mar 7/8*	Intro to enzyme catalysis and regulation	Enzyme assays
10	Mar 21/22*	Studying protein hydrodynamic properties	Determining protein oligomeric state by measurement of hydrodynamic properties
11	Mar 28/29	Enzyme kinetics and inhibition	Michaelis-Menten enzyme kinetics
12	Apr 4/5	Molecular recognition/substrate specificity	Substrate specificity
13	Apr 11/12	Methods for studying protein structure	Enzyme inhibition
14	Apr 18/19	Computational modeling tools for proteins	Ligand docking and optimization for drug discovery
15	Apr 25	<b>Exam 2 LILY 3118 8:00-9:30 PM</b>	Group work time for final research papers

*Weeks marked with an asterisk will be taught by Prof. Tao*



## Lab Safety

1. Approved **safety goggles** (with sideguards) must be worn by all persons (faculty/instructors, teaching assistants and students) in the laboratory any time there is work in progress by anyone. If you do not have safety goggles, they will be provided to you.
2. **Lab coats** must be worn by all persons (faculty/instructors, teaching assistants and students) in the laboratory any time there is work in progress by anyone. Lab coats may be purchased at the University Book Store, or Follet's. You will not be permitted to take part in any lab activity without your lab coat. All PPE should be removed before you leave the lab.
3. **Eating**, chewing gum, and/or **drinking** in the laboratory is strictly forbidden.
4. Many laboratory chemicals/reagents are **toxic**. If instructed to smell reagents, do so with great caution, and NEVER put your nose over the bottle! Avoid looking into the mouth of any reaction vessel or test tube; instead, view from the side. Never point a test tube at anyone.
5. **Proper attire** must be worn at all times. Closed-toe shoes are required at all times in the lab. The hemlines of shorts, skirts and dresses must be no higher than knee-length. Failure to adhere to the dress code will result in a grade penalty for the first occurrence, and you may be asked to leave the lab for further occurrences.
6. **Hair** that reaches the shoulders or longer must be tied back. Caps or hats must not be worn.
7. No one will perform **any unauthorized experiments**, nor will students work in the lab alone, or outside of regularly scheduled hours.
8. Keep a **clean working area**. Books, book bags, jackets etc. and paper should not clutter the workbench. Keep chairs and book bags recessed under cabinets when not in use.
9. Do not leave the lab until you have **cleaned up your work area** and returned supplies and equipment to the appropriate area if necessary.
10. Follow the guidelines of your instructor or teaching assistant when handling any **hazardous materials**. Be aware of the safety labeling on containers to identify risks associated with the materials.



11. Follow the guidelines of your instructor or teaching assistant for **waste disposal**. Dispose of the excess chemicals in the proper waste container, as indicated by the lab instructor or teaching assistant.
12. When pouring something out of a reagent bottle, always **READ THE LABEL TWICE** to be certain that you are using the correct material.
13. **Label** all chemical containers and test tubes before use to avoid mix-ups.
14. If you spill something, **clean it up (GET HELP WITH HAZARDOUS MATERIALS)!** Wash your hands immediately after skin contact with any chemical reagent. Also wash them after lab. If liquids drip down the side of the bottle, while pouring, wash the bottle off.
15. NEVER return excess chemicals to the reagent bottle.
16. Exercise care when **handling glass**.
  - Do not use broken or chipped glassware.
  - Do not leave pipettes sticking out of bottles, flasks or beakers.
  - Do not attempt to remove stoppers on glass tubing by force.
  - Hot glass must be handled with heat-resistant gloves, and any container containing heated materials must remain vented and be handled with extreme caution.
17. Do not operate **centrifuges** without supervision from instructor or teaching assistant.

## GENERAL SAFETY AND FIRST AID

18. Aisles and exit routes must not be obstructed in any way. Therefore, keep the stools pushed under or next to the bench. Keep book bags and other personal items where they will not be an obstruction hazard.

19. Report all accidents of any type to your instructor immediately. This includes electrical shocks, chemical spills, and bodily exposure to chemicals, biologics and all other types of exposures and/or injuries.

- The instructor, in consultation with the teaching lab coordinator, if necessary, will evaluate the exposure, counsel the student, and treat the exposure as deemed appropriate.
- If deemed necessary, the student will be referred to PUSH for consultation/medical treatment.
- An Incident Report Form must be completed for all exposures and/or injuries that occur in the teaching lab (BCHM 112) and a copy provided to the student and teaching lab coordinator.
- In the case of ANY incident resulting in injury to a student, the student is advised to receive medical attention from PUSH. Department of Biochemistry lab personnel are not medical professionals, and medical opinions can only be obtained from PUSH.

20. An eyewash station and safety shower should be used in the event of exposure of the eyes to hazardous materials or skin exposure to hazardous materials that cannot be managed using a faucet at the sink. Do not hesitate to use these if an exposure to hazardous material has occurred.

21. A first aid cabinet is located in the laboratory. Notify the instructor when items are used so supplies may be replaced.

22. In the case of fire in the lab, immediately notify the instructor or teaching assistant and use the RACE acronym:

- REMOVE anyone from danger.
- ALARM – activate the fire alarm first. Then call 911.
- CONTAIN – contain the fire, close doors and windows etc. when leaving the area.
- EXTINGUISH – Only if you have been trained in its use *and* it is safe for you to do so, use the fire extinguisher to control the fire.

NOTE: There is a carbon dioxide fire extinguisher in the lab to the right of the whiteboard. Do not attempt to use it unless you have been trained in its use. It may be used on liquid fires and electrical fires only.

## **EVACUATION PROCEDURES**

The building alarm will sound inside the building in the case of fire, or other emergency that requires your evacuation.

- If this alarm sounds, you must evacuate the building immediately.
- Shut off any equipment that you were using, remove personal protective equipment, gather your personal items if the situation permits and leave immediately through the main exit onto South University Street.
- Proceed to the emergency assembly area outside NLSN. Notify your instructor if you notice that one of your lab colleagues is no longer with your group. Do not leave this area without consulting directly with your instructor.

## **SHELTER-IN-PLACE PROCEDURES**

The outdoor all-hazards alarm will sound if you need to shelter in place due to inclement weather (including tornadoes), hazardous materials release, active shooter or other civil disturbance.

- To shelter-in-place, follow the directions of your instructor.
- Do not leave the building unless you are cleared to do so by your instructor.

## **Department of Biochemistry Teaching Laboratory (BCHM 322) Safety Rules**

Student acknowledgement and declaration of cooperation.

Course: BCHM 322

Semester: Spring 2018

Instructor: Professors Gimble and Tao

I have read the safety rules for the Department of Biochemistry Teaching Laboratory (BCHM 322), understand all of the procedures, and agree to abide by them. I understand that failure to comply with safety procedures could result in the suspension of my laboratory privileges or disenrollment from the course.

Signed \_\_\_\_\_

Date \_\_\_\_\_

Incident Response Form- Department of Biochemistry

<b>Student Name:</b>	<b>Course:</b>
<b>Major:</b>	<b>Instructor:</b>
<b>Date/Time of incident:</b>	<b>Student Phone:</b>
	<b>E-Mail:</b>
<b>Witness(es):</b>	
<b>Description of incident: Include the use of Personal Protective Equipment, chemical hood or other environmental control, safety equipment (attach additional pages if necessary).</b>	
<b>Did the incident result in an injury</b> Yes <input type="checkbox"/> No <input type="checkbox"/> <b>Description of injury:</b>	
<b>Details of action taken:</b>	
<b>Did student indicate they would visit PUSH?:</b> Yes <input type="checkbox"/> No <input type="checkbox"/> <b>NOTE: The Department of Biochemistry asks students to visit PUSH to have all injuries evaluated by trained medical professionals.</b>	
<b>Emergency response information (include EH&amp;S, fire, police, ambulance response present at the scene):</b>	
<b>Copy of this completed form provided to:</b> Student: Yes <input type="checkbox"/> No <input type="checkbox"/> Teaching Lab Coordinator: Yes <input type="checkbox"/> No <input type="checkbox"/>	
<b>Instructor Signature:</b>	<b>Student Signature:</b>
<b>Date:</b>	<b>Date:</b>