



DEPARTMENT OF BIOCHEMISTRY

BCHM 60501 – Macromolecules

3.00 Credit Hours

Fall 2021

COURSE INFORMATION

- **Course number and title:** BCHM 60501-Macromolecules
- **CRN: 15564**
- **Meeting times:**
Lecture: Monday/Wednesday/Friday 10:30-11:20 AM, LILY 3410
- **Instructional Modality: Face-to-Face**
Course Credit hours: 3.00
- **Course Brightspace page:** <https://purdue.brightspace.com/d2l/home/331460>

INSTRUCTOR: Professor Frederick Gimble
office: BCHM 10
TEL: 4-1653
e-mail: fgimble@purdue.edu

Office hours: By appointment for in-person or online meetings

TEACHING ASST: Mr. Gilbert Kayanja
office: BCHM 305
TEL: 4-8335 (laboratory)
e-mail: gkayanja@purdue.edu

Office hours: Mon. and Wed. 11:30-12:30 BCHM 305

COURSE DESCRIPTION

This course will provide students with an understanding of the basic principles that underlie the secondary and tertiary structure of proteins and nucleic acids which contribute to their function. It will inform students of current efforts to engineer macromolecules with novel functions. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and they will learn to critically evaluate the accuracy of structural models. Special topics in the current literature, including membrane proteins, drug design and ribozymes, will be covered. The class will typically include students from a variety of departments, graduate programs, and scientific backgrounds. The course will be taught primarily from various textbook and from the primary literature. A biochemistry course designated for majors is a prerequisite of the course. Lack of the prerequisite will require approval of the instructor. Permission of Department required.

A typical BCHM 60501 class includes students from a variety of departments, graduate programs, and scientific backgrounds. In this course we will explore the properties of proteins and nucleic acids from the perspective of the basic principles that underlie macromolecular structure. In the post-genomic age, we can use sequence analyses to predict protein and nucleic acid structure and to give clues as

to their functions. Students will learn the basic concepts behind these techniques. Students will become familiar with methods used to determine the three-dimensional structures of macromolecules, and learn how to critically evaluate the accuracy of such structures. We will explore special topics in macromolecular science, including membrane proteins, CRISPR Cas genome modification and ribozymes, from structural and mechanistic perspectives.

DEPARTMENTAL LEARNING OUTCOMES ADDRESSED BY THIS COURSE

- BCHM 60501 students will be able to describe the chemical structures of the building blocks of biological macromolecules, including amino acids and nucleic acids.
- BCHM 60501 students will demonstrate knowledge of the higher order structures of proteins and nucleic acids and be able to define the molecular forces that stabilize them.
- BCHM 60501 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.

TEXTBOOKS

Proteins: Structures and Molecular Properties (Thomas E. Creighton) no ebook
Biophysical Chemistry of Nucleic Acids and Proteins (Thomas E. Creighton)
Online

Physical and Chemical Basis of Molecular Biology (Thomas E. Creighton)
Online

Protein Structure and Function, Primers in Biology (Gregory A. Petsko and Dagmar Ringe
Introduction to Protein Structure (Carl Branden and John Tooze)

Structure and Mechanism in Protein Science: A guide to Enzyme Catalysis and
Protein Folding (Alan Fersht).

Nucleic Acids: Structures, Properties and Functions (Bloomfield, Crothers,
Tinoco)

Some of the course material is taken from these texts but it is NOT necessary to purchase them. The books are on reserve at Purdue libraries (WALC). Two of the texts (shown in bold) are available online through the Purdue Library website.

BRIGHTSPACE

The syllabus for the course, lecture notes, and grading keys for problem sets and exams will be available via the Purdue University Brightspace site:

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

ASSIGNMENTS

Your learning will be assessed through a combination of problem sets, student presentations and examinations. Details on these assignments and exams will be posted on Brightspace.

Problem sets:

Problem sets will be distributed during the semester on Brightspace according to the schedule. Problem sets will be due one week following distribution. Students are permitted to work together on problem sets but must write up their own answers.

Student presentations:

Groups of students will prepare presentations to inform the rest of the class about cutting-edge findings relating to the structure and function of macromolecules. There will be four presentation days during the semester, and on each day, two presentations will be given. Each member of the class will be assigned to a group consisting of ~3-4 students. The groups will each be sent a paper to read, and members of the group will work together to prepare a 15 minute presentation. Each member of the group will separately prepare a

single-spaced one-page summary description of the paper to hand in on the day of the presentation. The score for the assignment will be based on the presentation (40 pts, which will be the same for each group member) and the written assignment (40 pts).

Exams:

There will be in-class midterm examinations and a final exam. None of the exams is cumulative. Make-up exams will be provided at the discretion of the instructor.

Missing an exam will result in a grade of 0 being recorded. Any request to be excused from an exam should include documentation (request from academic advisor, etc.) explaining why the exam was or will be missed. The decision to allow a makeup exam is at the discretion of the instructor. Assignments that are received 1-24 hours after the time due will incur a 40% deduction and no assignments will be accepted after the 24 hour “late” window.

If you have any disagreements with the grading of the exams, please consult the grading key first and then submit your paper to the lecture TA or instructor along with a written description of your concerns.

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

The grading for this course will be as follows:

Problem sets	180 points
Class Presentations/written summary	80 points
Exam 1	180 points
Exam 2	180 points
Final Exam	180 points

GRADING SCALE

The cutoff values for letter grades are as follows (no +/- scores are given):

720 points	A
640 points	B
560 points	C
480 points	D
479 points and below	F

EXTRA CREDIT

There will be no opportunity for extra credit unless discussed explicitly during class.

OBTAINING EXTRA HELP

Dr. Gimble and the course teaching assistant will be available to answer your questions by e-mail or by arranging an in-person or virtual meeting.

CLASS ATTENDANCE

Students are expected to be present for class but attendance is not taken. When conflicts or absences 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 absences when

advance notification to the instructor is not possible, the student should contact the instructor as soon as possible by email or 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 falling under excused absence regulations, the student or the student's representative should contact or go to the [Office of the Dean of Students website](#) to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted for cases of grief/bereavement, military service, jury duty, and parenting leave. For details, see the [Academic Regulations & Student Conduct section](#) of the University Catalog website. Guidance on class attendance related to COVID-19 are outlined in the [Protect Purdue Pledge for Fall 2021](#) on the Protect Purdue website.

ACADEMIC GUIDANCE IN THE EVENT A STUDENT IS QUARANTINED/ISOLATED

If you must miss class at any point in time during the semester, please reach out to me via email so that we can communicate about how you can maintain your academic progress. If you find yourself too sick to progress in the course, notify your adviser and notify me via email or Brightspace. We will make arrangements based on your particular situation. Please note that, according to [Details for Students on Normal Operations for Fall 2021](#) announced on the Protect Purdue website, "individuals who test positive for COVID-19 are not guaranteed remote access to all course activities, materials, and assignments."

ACADEMIC INTEGRITY

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

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 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."

Determination of academic misconduct by the instructor will result of forwarding of that information to the Dean of Students office. At the least, a grade of zero will be given for the assignment or exam.

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 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 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. A hyperlink to Purdue's full

Nondiscrimination Policy Statement is included in our course Brightspace under University Policies.

MENTAL HEALTH

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 contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

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 on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

BASIC NEEDS SECURITY

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the [Critical Needs Fund](#)

ACCESSIBILITY AND ACCOMODATIONS

Purdue University is committed to making learning experiences accessible. 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 or by phone: 765-494-1247.

DISCLAIMER

This syllabus is subject to change

2021 LECTURE SCHEDULE (Tentative)

Lecture/Date	Instructor	Topic
1. August 23	Gimble	Introduction to BCHM60501/Elements of protein structure, Pymol
2. August 25	Gimble	Elements of protein structure: Introduction, Primary, Secondary structure
3. August 27	Gimble	Elements of protein structure: Tertiary structure
4. August 30	Gimble	Elements of protein structure: Quaternary structure
5. September 1	Gimble	Elements of protein structure: protein sequence analysis structure prediction
6. September 3	Gimble	Elements of protein structure: Protein stability
7. September 8	Gimble	Elements of protein structure: Protein folding and stability PS #1 due
8. September 10	Gimble	Elements of protein structure: Protein Folding <i>Student Presentations</i>
9. September 13	Gimble	Amyloids
10. September 15	Gimble	Elements of protein structure-Determining structure
11. September 17	Post	Elements of protein structure-Determining structure
12. September 20	Gimble	Elements of protein structure-Determining structure
13. September 22	Gimble	Membrane proteins PS #2 due
Optional Review	TBA	
14. September 24		<i>Student Presentations</i>
15. September 27	Exam 1	<u>No class</u> Exam 1: 8:00-10:00 pm LWSN B155
16. September 29	Hall	Proteomics
17. October 1	Hall	Post-translational modifications
18. October 4	Hall	Proteins and Introduction to proteomics
19. October 6	Gimble	<i>Student Presentations</i>
20. October 8	Gimble	Binding and physical interaction methods
21. October 13	Gimble	Binding and physical interaction methods
22. October 15	Gimble	Special Topic
23. October 18	Gimble	Synthetic Biology
24. October 20	Gimble	Synthetic Biology
25. October 22	Gimble	Synthetic Biology
26. October 25		<i>Student Presentations</i> PS #3 due
27. October 27	Gimble	Nucleic acid chemical properties
Optional Review	TBA	
28. October 29	Gimble	RNA structure and structure prediction
29. November 1	Exam 2	<u>No class</u> Exam 2: 8:00-10:00 pm LWSN B155
30. November 3	Gimble	RNA secondary and tertiary structure
31. November 5	Gimble	RNA secondary and tertiary structure
32. November 8	Gimble	Unusual nucleic acid structures
33. November 10	Gimble	Unusual nucleic acid structures
34. November 12	Gimble	Protein-nucleic acid interactions
35. November 15	Gimble	mRNA splicing
36. November 17	Gimble	RNA silencing
37. November 19	Gimble	Riboswitches PS #4 due
38. November 22	Gimble	Riboswitches
39. November 29	Gimble	CRISPR-Cas
40. December 1	Gimble	CRISPR-Cas
November 25/27	Thanksgiving-No Class	
41. December 3	Gimble	CRISPR-Cas (online)
42. December 6	Gimble	<i>Student Presentations</i>
43. December 8	Gimble	TBD
44. December 10	Gimble	

FINAL EXAMINATION-Date and time to be announced