

**BIOCHEMISTRY I**  
**CHEM 181, CHEMENG 181/281**  
**PROF. CEGELSKI**  
**AUTUMN 2023**

This course will introduce students to concepts in biochemistry. We will integrate fundamental principles in chemistry and biology to demonstrate how experiments and theory reveal the behavior of biomacromolecules, macromolecular complexes, and complex cellular systems. The class is divided into two main parts: Part 1: Examining Biomolecules – the Building Blocks of Life; and Part 2: Protein Activity.

Part 1 will focus on the structure, properties, and characterization of four major classes of biomolecules: proteins, carbohydrates, lipids, and nucleic acids. Part 2 will focus on enzyme kinetics, mechanisms and regulation of protein activity, and manipulation of protein activity including efforts in drug development. We will also explore how the topics discussed in class relate to current biochemical research.

The course assumes mastery of the prerequisite course Chem 121, which itself requires mastery of introductory organic chemistry, Chem 33.

**INSTRUCTOR:**

Professor Lynette Cegelski  
Department of Chemistry  
Email: [cegelski@stanford.edu](mailto:cegelski@stanford.edu)  
Office Hours: Tuesday 1:00 – 2:00 PM in Keck 351

Office: Keck 351  
Phone: 650-725-3527

**TEACHING ASSISTANTS:**

<i>Name</i>	<i>Email</i>	<i>Office Hours</i>
Dayanne Carvalho	<a href="mailto:drcarv@stanford.edu">drcarv@stanford.edu</a>	To be posted
Seokyoung Lee	<a href="mailto:sylee23@stanford.edu">sylee23@stanford.edu</a>	Wednesdays 4:15-5:15 PM, STLC 116

**WEBSITE:** The class website can be found on the *Canvas* system (<http://canvas.stanford.edu>). The site contains: lecture slides; additional reading; problem sets and solutions; practice exams; and an up-to-date calendar including all office hours.

**LECTURES:** Tuesdays and Thursdays, 9:00 – 10:20 AM, Chem Gazebo

**DISCUSSION SECTION:** Thursdays 1:30-2:50 PM, Chem Gazebo

**TEXTBOOK / E-BOOK:** The required text is Biochemistry, 9<sup>th</sup> Edition, by Berg, Tymoczko, Gatto, and Stryer. 8<sup>th</sup> Edition or 10<sup>th</sup> Edition is also OK. We expect you to read the chapter(s) **before** class.

Other recommended texts and alternate views of material:

The Molecules of Life: Physical and Chemical Principles, by Kuriyan, Konforti, and Wemmer.

Physical chemistry for the life sciences, by Atkins and de Paula.

Fundamentals of Biochemistry: Life at the Molecular Level, by Voet, Voet, and Pratt.

**GRADING (EXAMS AND PROJECT):** Grading will be based on one midterm exam (45%), a final exam (45%), and an independent project involving an oral presentation and leading questions in another presentation (10%). The midterm exam will be given during class on Tuesday, October 31. The final exam will be on Wednesday, December 13 at 8:30 AM. The final exam will cover material from the whole quarter, though with a larger and major emphasis on material in the second half of the course. Both the midterm and final exams will be closed book. You may use a simple calculator. No phones or computers or graphing or programmable calculators are allowed.

**Final course grades** will be earned and assigned as follows:

90 and above = A; 85-89 = A- ; 80-84 = B+ ; 75-79 = B ; 70-74 = B- ;  
65-69 = C+ ; 60-64 = C ; 55-59 = C- ; 40-54 = D ; 0-39 (NP) .

If taking the course for credit/no credit, one must earn a grade of 55 or greater to receive CRedit.

**PROBLEM SETS:** As an additional resource for learning and mastering course content, problem sets and solutions will be posted each week, but will not be graded. These are meant to enhance student learning and to reinforce concepts through problem-based questions.

**STUDENTS WITH DOCUMENTED DISABILITIES:** Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066, URL: <http://studentaffairs.stanford.edu/oea>).

**IMPORTANT DATES:**

10/13 (Fri) – Study list deadline; Final day to add or drop a class

10/31 (Tues) – Midterm (in class)

11/7 (Tues) – Term withdrawal deadline

11/7 (Tues) – Democracy Day (no class)

11/17 (Fri) – Change of grading basis deadline; Course withdrawal deadline

11/20-11/24 (Mon-Fri) – Thanksgiving Recess (no classes)

12/5 (Tues) and 12/7 (Thurs) – Final week of classes / End-quarter period

12/13 (Wed)– Final Exam (Registrar time slot 8:30-11:30AM; exact time length TBD)

**CHEM 181 - FALL 2023 LECTURE SCHEDULE (LECTURES: 9:00-10:20AM IN STLC 118)**

LECTURE	DATE	TOPIC	CHAPTER (9 <sup>TH</sup> Ed)
<i>PART 1 – Examining Biomolecules - the Building Blocks of Life</i>			
1	9/26 (Tues)-9:00AM	Intro to class; Basic principles of biological systems; Protein composition and structure	1-2
2	9/28 (Thurs)-9:00AM	Protein properties and purification	2-3
	<a href="#">9/28 (Thurs)-1:30PM</a>	<a href="#">PyMol and AlphaFold 2 – Tutorial and Practice</a>	
3	10/3 (Tues)-9:00AM	Proteins and biophysical characterization: crystallography, CryoEM, fluorescence, mass spectrometry	2-3
4	10/5 (Thurs)-9:00AM	DNA, RNA, and the flow of information	4
	<a href="#">10/5 (Thurs)-1:30PM</a>	<a href="#">Visualizing Quantitative Data ; Q&amp;A on Projects</a>	
5	10/10 (Tues)-9:00AM	Genes and genomes; Bioinformatics	5-6
6	10/12 (Thurs)-9:00AM	The ribosome and protein synthesis	31
	<a href="#">10/12 (Thurs)-1:30PM</a>	<a href="#">Literature &amp; Problem Solving - DNA-RNA-Protein</a>	
7	10/17 (Tues)-9:00AM	Intro to Kinetics	
8	10/19 (Thurs)-9:00AM	Enzymes: introductory concepts and kinetics	8
	<a href="#">10/19 (Thurs)-1:30PM</a>	<a href="#">Problem Solving - Enzyme Kinetics</a>	
9	10/24 (Tues)-9:00AM	Catalytic mechanisms	9
10	10/26 (Thurs)-9:00AM	Lipids and Membrane Proteins	12
	<a href="#">10/26 (Thurs)-1:30PM</a>	<a href="#">Problem Solving – Midterm Review</a>	
	<b>10/31 (Tues)-9:00AM</b>	<b>MIDTERM EVALUATION (Lectures 1-10)</b>	
11	11/2 (Thurs)-9:00AM	Hemoglobin and myoglobin; Allostery	7
	<a href="#">11/2 (Thurs)-1:30PM</a>	<a href="#">Literature &amp; Problem Solving</a>	
	11/7 (Tues)-9:00AM	--- <b>No Class – Democracy Day</b> ---	--
12	11/9 (Thurs)-9:00AM	Carbohydrates	11
	<a href="#">11/9 (Thurs)-1:30PM</a>	<a href="#">Open Office Hrs; Presentation Paper Questions Welcome</a>	
13	11/14 (Tues)-9:00AM	Regulatory mechanisms	10
14	11/16 (Thurs)-9:00AM	Membrane Channels and Pumps	
	<a href="#">11/16 (Thurs)-1:30PM</a>	<a href="#">Problem Solving (Focus on Lectures 12-14)</a>	
<b>---11/22 and 11/24 – Thanksgiving Holiday – No class ---</b>			
15	11/28 (Tues)-9:00AM	Signal transduction	14
16	11/30 (Thurs)-9:00AM	<b>PRESENTATIONS</b>	
17	<a href="#">11/30 (Thurs)-1:30PM</a>	Molecular motors	36 (online)
18	12/5 (Tues)-9:00AM	<b>PRESENTATIONS</b>	
19	12/7 (Thurs)-9:00AM	Drug discovery and final synopsis	28
20	<a href="#">12/7 (Thurs)-1:30PM</a>	<b>PRESENTATIONS</b>	
	12/13 (Wed)-8:30AM	<b>FINAL EXAM</b>	

**2023 Presentation Project Deadlines:**

**10/12 (Thurs):** Identify partner for presentation project or ask to be paired up and email details to Dayanne Carvalho

**10/12 – 11/3:** Meet with Prof. Cegelski or a TA to discuss paper or papers of interest

**11/6 (Mon):** Final deadline to submit your approved project paper/topic selection to assigned TA

**11/10 (Fri):** Submit your project Abstract as a Word file to assigned TA. These will be compiled and emailed to class over the weekend.

**11/14 (Tues):** Submit selection of 2-3 Abstracts of most interest to you for possible assignment to closely review and ask question(s) of during presentations and submit selections by email to assigned TA.

**11/17:** Your assigned presentation to be a key questioner at will be assigned.

**11/30 (Thurs) and 12/5 (Tues):** Presentations!