BCHM 335/L: Biochemistry I – Biomolecules **Fall 2020**

COURSE SYLLABUS

Section	Day	Time	Location	Instructor
LECTURE	**Mon, Wed, Fri**	**10:00-10:50 am**	**Beckman 150**	**Dr. Cedric Owens**

Instructor Office Hours

Dr. Cedric Owens – Lecturer
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Office: Keck 226
Office hours: Mon 11:00am-12pm, Thu 4:00pm-5:00pm, by appointment

Catalog Description

Prerequisites: CHEM 230, CHEM 331. Biochemistry is the chemistry of life. It is the study of the chemical and molecular interactions that take place in and, in effect, constitute living organisms. In BCHM 335: Biochemistry I - Biomolecules, students will examine the structure and function of the fundamental building blocks of life (carbohydrates, lipids, proteins and nucleic acids). Lecture and laboratory (offered every fall semester), 4 credits, $75 lab fee.

Course Learning Outcomes

Upon successful completion of the course, the student will be able to:

Knowledge

1. Identify the major classes of biomolecules (amino acids, sugars, lipids, and nucleic acids) and describe the chemistry that defines them.
2. Describe the forces of attraction between molecules and types of chemical bonds.
3. Describe the relationship between the three-dimensional structure of proteins and their biological activity.
4. Describe protein folding, denaturation, and supramolecular assemblies.
5. Describe enzyme mechanisms, structure, function, regulation and kinetics.
6. Describe the basic steps in recombinant DNA technology.
7. Describe the major functions of carbohydrates in biological systems.
8. Describe the composition and architecture of membranes.

Comprehension

1. Explain the importance of water as a determinant of biological activity.
2. Explain replication, transcription, and translation.
3. Calculate protein concentrations and enzymatic activities from acquired data.
4. Explain the significance of buffers.
5. Explain how an allosteric protein communicates with its environment.
6. Convert Fischer and Haworth structures of sugars.
7. Explain how membranes self-assemble and model a functioning membrane.
8. Perform and explain the isolation and characterization of proteins and other biomolecules.
9. Perform, interpret and explain common biochemical techniques such as spectroscopy, chromatography, electrophoresis, and immune detection.

Application

1. Apply reasoning skills acquired in the classroom to practical problem solving in the lab.
2. Solve buffer problems and acid/base equilibrium problems.
3. Collect data from experiments designed to test specific hypothesis.
4. Demonstrate safe and effective laboratory practices in line with established protocols.

Analysis

1. Compare protein, sugar, lipid, and nucleic acid structure and function.
2. Analyze data and interpret results from experiments (amino acid titration/buffers; protein purification techniques including ion exchange chromatography, molecular sieve chromatography, paper chromatography, gel electrophoresis, and immunodetection; enzyme kinetics and inhibition; lipid analysis).
3. Dissect a problem into its key features.

Synthesis

1. Design experiments, use appropriate controls, and understand the limitations of different experimental approaches.
2. Predict the function of biomolecules based on their structure.
3. Conduct experiments and draw conclusions as to their significance.

Evaluation

1. Evaluate the validity of an experimental design.
2. Evaluate a hypothesis in light of data obtained.
3. Make conclusions based on raw data.
4. Assess membrane dynamics and function based upon central concepts.

Program Learning Outcomes

In addition to the above learning outcomes, BCHM 335 supports the program learning outcomes for the B.Sc. in Biochemistry and Molecular Biology:

1. Students will be able to apply the scientific method to solve problems.
2. Students will be able to demonstrate written, visual, and oral presentation skills to communicate scientific knowledge.
3. Students will be able to apply critical thinking and analytical skills to design and execute a scientific experiment, thoroughly analyze the results, and arrive at well-reasoned scientific conclusions.
4. Students will be able to demonstrate mastery of core knowledge in biochemistry.
5. Students will be able to demonstrate basic laboratory skills.

Major Study Units

1. Amino Acids, peptides, and polypeptides
2. Protein structure and function
3. Experimental methodologies
4. 3-D structure of proteins
5. Globular and fibrous proteins
6. Enzyme kinetics
7. Mechanisms of enzyme action
8. Control of enzymatic activity
9. Chemistry of lipids
10. Introduction to biological membranes
11. Transport mechanisms and 2nd messenger systems
12. Carbohydrates and glycoproteins
13. Chemistry of nucleic acids and DNA
14. DNA manipulation and its applications

Books / Texts

- Required: Nelson & Cox. Lehninger Principles of Biochemistry, 6th edition and up
- Recommended: Osgood & Ocorr. The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry, 6th edition: Study Guide and Solutions Manual
- Lab Manual: Provided by Lab Instructors (lab fee: $75)

Instructional Strategies

Most of the class is conducted in a lecture format with in class exercises in critical thinking. Reading assignments will be posted for every chapter covered. In the lab, students will design experiments to test hypotheses, evaluate and interpret data, and write lab reports in the style of a journal article.

Methods of Evaluation

There will be 4 exams in this course. The exams will cover new material only and will consist of problem solving, multiple choice and short answer questions, testing knowledge acquisition, critical analysis, integration, and creative synthesis. Problem sets will be assigned periodically and representative problems may appear on exams. Quizzes will be announced and scheduled at various times (not predetermined) during the course.

Grading will be determined by totaling the points earned from the four exams (660 pts), a protein modeling assignment (40 points) and quizzes (60 pts). The laboratory portion of the course is worth 240 points. Lab reports will be graded according to the published rubric on Blackboard. Accumulation of points totaling 595-624 will earn the grade of D-, 625-674 = D, 675-694 = D+, 695-724 = C-, 725-774 = C, 775-794 = C+, 795-824 = B-, 825-874 = B, 875-894 = B+, 895-924 = A-, and 925-1000 = A.

Make-up Policy

Students can miss one laboratory class. Quizzes and exams can be made-up only with prior consent of instructor. All make-ups must be completed before the tests are handed back to the class.

Laboratory

Working in teams of two, students will complete all scheduled experiments. All laboratory work must be recorded in a bound laboratory notebook. Typed reports will be collected for grading on scheduled due dates. Laboratory reports for each experiment will be written using the following sections: Title, Abstract, Introduction and Experimental Theory. Procedures and Rational, Results (Data Collection and Analysis), Discussion, Conclusion and Bibliography. A detailed explanation of laboratory reports will be provided on Blackboard and in class handouts.

Students are required to follow all safety rules and standards set forth by Schmid College of Science and Technology. Students not following these standards may be asked to cease activities and/or leave the laboratory. Laboratory instructors have full discretion to assess penalties as they see fit should students violate any of these policies. Furthermore, students are required to wear close-toed shoes, long pants, lab coats, and appropriate eye protection to participate in lab activities. Students will be asked to leave lab and marked absent if not appropriately attired.

Academic Integrity Policy

Chapman University is a community of scholars which emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work, and academic dishonesty of any kind will subject to sanction by the instructor and referral to the university Integrity committee which may impose additional sanctions including expulsion. Please see the full description of Chapman University's policy on Academic Integrity at www.chapman.edu/academics/academicintegrity/index.aspx. Cheating on exams or plagiarism will result in a zero (no credit) for that assignment or exam.

Students with Disabilities Policy

In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Disability Services Office. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516–4520 or visit www.chapman.edu/students/student-health-services/disability-services if you have questions regarding this procedure or for information or to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and cannot jeopardize the academic standards or integrity of the course.

Equity and Diversity

Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman's Harassment and Discrimination Policy: http://tinyurl.com/CUHarassment-Discrimination. Any violations of this policy should be discussed with the professor, the Dean of Students and/or otherwise reported in accordance with this policy.

Instructional Format

Instruction will be held remotely via Zoom. Attendance in lectures and labs is mandatory. Office hours will also be held via Zoom. You will need a computer with audio and video and a wifi connection. Please contact the instructor if you need help with the course technology.

Class Schedule with Exam Due Dates

Week	Dates	Chapter and Topic	Exam
1	Aug 31, 2, 4	2: The Matrix of Life: Water, Buffers	
2	Sep 9, 11	3: Amino Acids, Peptides, and Proteins	
3	Sep 14, 16, 18	3 Amino Acids, Peptides, and 4: 3D Structure of Proteins	
4	Sep 21, 23, 25	4: The 3D Structure of Proteins	Exam 1
5	Sep 28, 30, Oct 2	5: Protein Function and Evolution	
6	Oct 5, 7, 9	6: Enzymes: Biological Catalysts	
7	Oct 12, 14, 16	6: Enzymes: Biological Catalysts *continued*	
8	Oct 19, 21, 23	7: Carbohydrates and Glycobiology	Exam 2
9	Oct 26, 28, 30	7: Carbohydrates and Glycobiology *continued*	
10	Nov 2, 4, 6	8: Nucleotides and Nucleic Acids	
11	Nov 9, 11, 13	8, 9: Nucleotides, DNA-based information Technologies	
12	Nov 16, 18, 20	9: DNA-based information Technologies *continued*	Exam 3
13	Nov 23-27	Thanksgiving	
14	Nov 30, Dec 2, 4	10: Lipids	
15	Dec 7, 9, 11	11: Biological Membranes and Cellular Transport 12: Introduction to Biosignaling	

Final Exams

Wednesday, Dec 16 at 8 am – 10:30 pm in Beckman Lecture Hall (HSC 150)

In this class, software will be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded to assist those who cannot attend the live session, or to serve as a resource for those who would like to review content that was presented. These recordings will be made available only to students who are enrolled in the class, and only during the period in which the course is offered. All recordings will become unavailable to students in the class shortly after the course ends. Students who prefer to participate via audio only will be allowed to disable their video camera so only audio will be captured. Please discuss this option with your instructor.

In response to the current COVID-19 pandemic, Chapman University has developed the CU Safely Back program (CUSBP) and mandatory safety measures (https://news.chapman.edu/coronavirus/). The University's mandatory safety measures may be stricter than local, state or federal guidelines and may be subject to change at any time. Students are expected to adhere to the University's safety measures while attending classes, including when entering and exiting classrooms, laboratories, or other instructional areas. Individual faculty may choose to have requirements for their courses that are stricter than the University's. Safety precautions and procedures may change in response to emerging findings and the recommendations of scientific experts and authorities. Refusal to abide by the University's mandatory safety measures or to the safety requirements specific to this course will

result in your being asked to leave the area immediately, and may result in an administrative dismissal from this course.

The COVID-19 pandemic requires all of us to accept the possibility that changes in how this course is taught may be required and that some changes may occur with little or no notice. For example, some or all of the in-person aspects of a course may be shifted to remote instruction. If this occurs, you will be given clear instructions as to how to proceed. The uncertainty of the situation is not ideal for any of us. We must all try to approach this situation with good-will, flexibility, and mutual understanding.