

COMPREHENSIVE BIOCHEMISTRY I: Structural Biochemistry*The Molecular Architecture of Macromolecules and their Assemblages*

Lectures: M, W, F @ 11:00-11:50 AM; Health and Exercise Science 105

Instructor: Dr. Jeffrey Hansen
jeffrey.c.hansen@colostate.edu
Office: MRB 381
Office hours: Mon and Fri from 12-1 PM, and by appointment

Teaching Assistant: Travis Sanders
evo@rams.colostate.edu
Office hours by appointment

Lecture Slides: All lecture slides are pre-posted on Canvas. You will find it very helpful to go over the slides in as much detail as possible before lecture.

Exams/Grading: Grading will be based on four semester exams, homework, and a term paper. Traditional letter grades (including +/-) will be assigned.

Student Honor Code: This course will adhere to the Academic Integrity Policy of the Colorado State University **General Catalog {Page 7}** and the **Student Conduct Code**.

Course Philosophy and Instructor Expectations

BC401 is an upper division course that provides you with advanced knowledge of the structure of biological macromolecules and their complexes. The first two weeks cover the fundamentals of macromolecular structure: thermodynamics, the hydrophobic effect, and non-covalent interactions. After that we begin a 2-week section on nucleic acids, and then spend the rest of the class covering protein structure and function in increasing depth (see Lecture Schedule).

Attending lecture is important if you are to do your best in BC401. Each lecture is a separate subject, yet most build on one another as the course progresses. Therefore, it is essential to get off to a good start and quickly gain a grasp of the fundamentals. *If you are having troubles, please come to office hours or e-mail me and make an office hour appointment.*

Dr. Dave Fahrney (BMB Professor Emeritus) has provided the class with an *unparalleled* learning tool in the form of Jsmol Tutorials. These tutorials combine the 3-D graphics and user manipulability of the program, Jsmol, with topics and text written by Dr. Fahrney. The net effect is a *visual, interactive* guided tour through structural biochemistry. *The Jsmol Tutorials are the primary source of the information in my lecture notes.* Previously the tutorials were programmed to run independently from a CD. During the past several years this has become increasingly difficult to use and the tutorials were in danger of becoming inaccessible and obsolete. The Departments of Biochemistry and Molecular Biology and Computer Science have collaborated on

a project to convert the tutorials to run under internet accessible Jsmol. Eight of the most important Jsmol tutorials have been successfully converted to the new format and will be available to BC401 students at the relevant points in the course.

I use PowerPoint for my lectures. Each lecture has ~20 slides containing both text and images usually taken from the relevant Jsmol Tutorials. Included is a page of objectives that guide you through my expectations for that lecture. *The lectures are pre-posted on Canvas. **My slides serve as the primary source of information for test questions.*** Coming to class will greatly increase your understanding of the lecture material. The purpose of my lectures is to explain the material on the lecture slides. While I am lecturing, do your best to listen carefully to what I am saying. There is no need to frantically write down everything I say because what you need to know is already in front of you in the form of the slides.

There will be a total of 4 exams counting the final. The format of the exams will be a mixture of matching, multiple answer, fill in the blank, and short answer. Homework will be assigned most Fridays. A term paper will be due on the last day of class.

In sum, BC401 is a course where you are rewarded for coming to class, studying hard, and meeting expectations. If you do so you will learn a tremendous amount about nucleic acids and proteins, information that is essential for understanding the chemistry of life.

Learning Outcomes

1. Students should be able to compare and contrast the non-covalent interactions found in nucleic acids and proteins
2. Students should be able to describe and discuss the molecular architecture of nucleic acids
3. Students should be able to describe and discuss the molecular architecture of proteins.

Assessment: Quizzes, exam questions, and a writing assignment

LECTURE SCHEDULE

#	Date	Lecture Topic
Section 1: The Biochemical Alphabet		
1	JH 8/21, M	Course introduction
2	JH 8/23, W	Thermodynamics review
3	JH 8/25, F	Water; hydrogen bonds in water
4	JH 8/28, M	The hydrophobic effect
5	JH 8/30, W	Non-covalent interactions 1
6	JH 9/1, F	Non-covalent interactions 2
Section 2: Nucleic Acids		
--	9/4, M	No class, Labor Day
7	JH 9/6, W	DNA structure 1
8	JH 9/8, F	DNA structure 2
9	JH 9/11, M	RNA structure 1
10	JH 9/13, W	RNA structure 2
Section 3: Primary, Secondary, and Tertiary Structure of Proteins		
11	JH 9/15, F	Amino acids
E1	9/18, M	Exam 1 (covers lectures 2-11)
12	JH 9/20, W	Protein primary structure; the genetic code
13	JH 9/22, F	Secondary structure 1
14	JH 9/25, M	Secondary structure 2
15	JH 9/27, W	Tertiary structures
16	JH 9/29, F	Forces that stabilize globular proteins
17	JH 10/2, M	Protein folding
18	JH 10/4, W	Protein domains
19	JH 10/6, F	Intrinsic disorder
Section 4: Quaternary Structure and Protein Function		
20	JH 10/9, M	Quaternary structure; protein-protein interfaces
21	JH 10/11, W	Transthyretin: a lesson in protein symmetry and quaternary structure
E2	10/13, F	Exam 2 (covers lectures: 12-21)
22	JH 10/16, M	Coiled-coils; Collagen triple helix
23	JH 10/18, W	Hetero-associations: the KIX-pKID interaction

24	JH	10/20, F	Binding competition and energetics
25	JH	10/23, M	Protein-nucleic acid interfaces
26	JH	10/25, W	Globins and Oxygen Transport 1
27	JH	10/27, F	Globins and Oxygen Transport 2
28	JH	10/30, M	Globins and Oxygen Transport 3
29	JH	11/1, W	Globins and Oxygen Transport 4
30	JH	11/3, F	Globins and Oxygen Transport 5
31	JH	11/6, M	Enzymes 1
32	JH	11/8, W	Enzymes 2
E3		11/10, F	Exam 3 (covers lectures: 22-32)
33	JH	11/13, M	Membranes and membrane proteins 1
34	JH	11/15, W	Membranes and membrane proteins 2
35	ER	11/17, F	Prions

No Classes, 11/21-11/25. Happy Thanksgiving!

Section 5: Macromolecular Assemblages

36	JH	11/27, M	Molecular chaperones and protein folding 1
37	JH	11/29, W	Molecular chaperones and protein folding 2
38	JH	12/1, F	Ribosomes 1
39	JH	12/4, M	Ribosomes 2
40	JH	12/6, W	Nucleosomes and chromatin 1
41	JH	12/8, F	Nucleosomes and chromatin 2

Final Exam Tuesday, December 12, 7:30-9:30 AM (covers lectures 33-41)