

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

Lectures: M, W, F @ 3-3:50 AM; Clark A202

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Office hours: M, W @ 2-2:45 PM, or email me to set up an appointment

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Lecture Slides: All lecture slides are pre-posted on Canvas under the “Lecture PDFs” module. 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, 6-8 online quizzes, and in class assignments (~500 pts). Traditional letter grades (including +/-) will be assigned.

Default Grading Scheme

90-100%	A
80-89%	B
70-79%	C
60-69%	D
<60%	F

A decision whether to apply a curve will be made at the end of class.

Student Honor Code: This course will adhere to the Academic Integrity Policy of the Colorado State University General Catalog {Page 7} (<http://www.catalog.colostate.edu/Content/files/2012/FrontPDF/1.6POLICIES.pdf>) and the Student Conduct Code (<http://www.conflictresolution.colostate.edu/conduct-code>). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

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, water, the hydrophobic effect, and non-covalent interactions. After that we spend a week on the structure of DNA and RNA. The third section of the

class covers protein primary, secondary, and tertiary structure, while the fourth section surveys protein quaternary structure and function. The final section of the class is dedicated to macromolecular assemblages (see Lecture Schedule).

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.*** I always welcome all students to come see me regardless of how you are doing!

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 internet-accessibility, 3-D graphics, and user manipulability of the program, Jsmol, with topics and text written by Dr. Fahrney. The Jsmol tutorials offer a ***visual, interactive guided tour through structural biochemistry*** that can be accessed from your computer, tablet, or phone. ***The Jsmol Tutorials are the primary source of the information in my slides.*** Previously the tutorials were programmed to run from a CD. During the past several years this has become increasingly difficult to accomplish and the tutorials were in danger of becoming inaccessible and obsolete. I have recently spearheaded a project to convert the original CD-based tutorials to run under internet-accessible Jsmol. Many of the most important Jsmol tutorials have been successfully converted to the new format and will be available to BC401 students at <https://sites.bmb.colostate.edu/bc401/>.

I use PowerPoint for my lectures. Each lecture has ~20-25 slides containing both text and images (usually taken from the relevant Jsmol Tutorials). Included at the beginning of each lecture 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.***

There will be a total of four exams counting the final. The format of the exams will be a mixture of matching, multiple choice, and free form/essay questions. Canvas-based quizzes will be assigned on many Fridays. There also will be several in class assignments.

In sum, BC401 is a course where you are rewarded for coming to class, studying hard, and thinking. If you accomplish these things you will learn a great deal about the structure of nucleic acids and proteins, information that is essential for understanding the chemistry of life.

Learning Outcomes

Upon successful completion of this course, students will:

1. Know the non-covalent interactions found in nucleic acids and proteins
2. Understand the structure of nucleic acids
3. Understand the structure and dynamics of proteins.
4. Understand the molecular architecture of macromolecular assemblages.

Assessment: Exams, online quizzes, in class assignments

LECTURE SCHEDULE

#		Date	Lecture Topic
Section 1: The Biochemical Alphabet			
1	JH	8/26, M	Course introduction
2	JH	8/28, W	Thermodynamics review
3	JH	8/30, F	Water; hydrogen bonds in water
--		9/2, M	No class, Labor Day
4	JH	9/4, W	The hydrophobic effect
5	JH	9/6, F	Non-covalent interactions 1
6	JH	9/9, M	Non-covalent interactions 2
Section 2: Nucleic Acids			
7	JH	9/11, W	Nucleic acid structure 1
8	JH	9/13, F	Nucleic acid structure 2
9	JH	9/16, M	Nucleic acid structure 3
10	KV	9/18, W	<i>In class review</i>
Section 3: Primary, Secondary, and Tertiary Structure of Proteins			
11	JH	9/20, F	Amino acids
E1		9/23, M	Exam 1 (covers lectures 2-11)
12	JH	9/25, W	Protein primary structure; the genetic code
13	JH	9/27, F	Secondary structure 1
14	JH	9/30, M	Secondary structure 2
15	JH	10/2, W	Tertiary structures
16	JH	10/4, F	Forces that stabilize globular proteins
17	JH	10/7, M	Protein folding
18	JH	10/9, W	Protein domains + Intrinsic Disorder
Section 4: Quaternary Structure and Protein Function			
19	JH	10/11, F	Quaternary structure; protein-protein interfaces
20	JH	10/14, M	Transferrin; a lesson in self-association and C2 symmetry
21	JH	10/16, W	Supercoiled proteins: coiled-coils and the collagen triple helix
E2		10/18, F	Exam 2 (covers lectures: 12-21)
22	JH	10/21, M	Competition: the KIX-pKID and KIX-myb interactions
23	JH	10/23, W	Globins and Oxygen Transport 1

24	JH	10/25, F	Globins and Oxygen Transport 2
25	JH	10/28, M	Globins and Oxygen Transport 3
26	JH	10/30, W	Globins and Oxygen Transport 4
27	JH	11/1, F	Enzymes 1
28	JH	11/4, M	Enzymes 2
29	JH	11/6, W	Protein-nucleic acid interfaces
30	JH	11/8, F	Phospholipids, cholesterol and membranes
31	JH	11/11, M	Membrane proteins 1
32	JH	11/13, W	Membrane proteins 2

E3 **11/15, F** **Exam 3 (covers lectures: 22-32)**

Section 5: Macromolecular Assemblages

33	ER	11/18, M	Amyloid and prions
34	JH	11/20, W	Molecular chaperones and protein folding 1
35	JH	11/22, F	Molecular chaperones and protein folding 2

No Classes, 11/25-11/29. Happy Thanksgiving!

36	JH	12/2, M	Ribosomes
37	JH	12/4, W	ATP synthase
38	JH	12/6, F	Tryptophan attenuator
39	JH	12/9, M	<i>TBD</i>
40	JH	12/11, W	Nucleosomes, chromatin, and chromosomes
41	JH	12/13, F	Nucleosomes, chromatin, and chromosomes

Final Exam Wednesday, December 18 7:30-9:30 AM (covers lectures 33-41)