

**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  
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**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 and 6-8 quizzes. 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} (<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, the hydrophobic effect, and non-covalent interactions. After that we spend a week section on nucleic acids. The rest of the class covers protein structure and function in increasing depth (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 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. I recently took 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 write down everything I say because most of what you need to know is already in front of you in the form of the slides.

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

In sum, BC401 is a course where you are rewarded for coming to class, studying hard, meeting expectations, and thinking. If you accomplish these things, you will learn a tremendous amount about 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 and quizzes

## LECTURE SCHEDULE

#		Date	Lecture Topic
<b>Section 1: The Biochemical Alphabet</b>			
1	JH	8/20, M	Course introduction
2	JH	8/22, W	Thermodynamics review
3	JH	8/24, F	Water; hydrogen bonds in water
4	JH	8/27, M	The hydrophobic effect
5	JH	8/29, W	Non-covalent interactions 1
6	JH	8/31, F	Non-covalent interactions 2
<b>Section 2: Nucleic Acids</b>			
--		<b>9/3, M</b>	<b>No class, Labor Day</b>
7	JH	9/5, W	Nucleic acid structure 1
8	JH	9/7, F	Nucleic acid structure 2
9	JH	9/10, M	Nucleic acid structure 3
10	JH	9/12, W	Amino acids
<b>Section 3: Primary, Secondary, and Tertiary Structure of Proteins</b>			
11	JH	9/14, F	Protein primary structure; the genetic code
<b>E1</b>		<b>9/17, M</b>	<b>Exam 1 (covers lectures 2-11)</b>
12	JH	9/19, W	Secondary structure 1
13	JH	9/21, F	Secondary structure 2
14	JH	9/24, M	Tertiary structures
15	JH	9/26, W	Forces that stabilize globular proteins
16	JH	9/28, F	Protein folding
17	JH	10/1, M	Protein domains
18	JH	10/3, W	Intrinsic disorder
<b>Section 4: Quaternary Structure and Protein Function</b>			
19	JH	10/5, F	Quaternary structure; protein-protein interfaces
20	JH	10/8, M	Transferrin: a lesson in protein symmetry and quaternary structure
21	JH	10/10, W	Coiled-coils; Collagen triple helix
<b>E2</b>		<b>10/12, F</b>	<b>Exam 2 (covers lectures: 12-21)</b>
22	JH	10/15, M	Competition: the KIX-pKID and KIX-myb interactions
23	JH	10/17, W	Globins and Oxygen Transport 1

24	JH	10/19, F	Globins and Oxygen Transport 2
25	JH	10/22, M	Globins and Oxygen Transport 3
26	JH	10/24, W	Globins and Oxygen Transport 4
27	JH	10/26, F	Tryptophan attenuator: a 2 <sup>nd</sup> lesson in allostereism and cooperativity
28	JH	10/29, M	Enzymes 1
29	JH	10/31, W	Enzymes 2
30	JH	11/2, F	Phospholipids, cholesterol and membranes
31	JH	11/5, M	Membrane proteins 1
32	JH	11/7, W	Membrane proteins 2
<b>E3</b>		<b>11/9, F</b>	<b>Exam 3 (covers lectures: 22-32)</b>
33	JH	11/12, M	Protein-nucleic acid interfaces

### Section 5: Macromolecular Assemblages

34	JH	11/14, W	Molecular chaperones and protein folding 1
35	JH	11/16, F	Molecular chaperones and protein folding 2

**No Classes, 11/20-11/24. Happy Thanksgiving!**

36	ER	11/26, M	Amyloid and prions
37	JH	11/28, W	ATP synthases
38	JH	11/30, F	Ribosomes 1
39	JH	12/3, M	Ribosomes 2
40	JH	12/5, W	Nucleosomes and chromatin 1
41	JH	12/7, F	Nucleosomes and chromatin 2

**Final Exam Tuesday, December 11 4:10-6:10 PM (covers lectures 33-41)**