

# **BCH 6740 – STRUCTURAL BIOCHEMISTRY**

## **(BCH 6746, BCH 6747 and BCH 7515)**

**– Spring 2019 –**

**Class Time:** Period 4, 10:40 - 11:30 am, on Monday, Tuesday, Wednesday and Friday

**Class Location:** Room R3-265, Academic Research Building (ARB)

**Course Coordinator:** **Thomas H. Mareci, Ph.D.**

### **Instructors:**

Linda B. Bloom	lbloom@ufl.edu	(352) 294-8379	Room R3-165, Academic Research Building
Joanna R. Long	jrlong@mbi.ufl.edu	(352) 294-8399	Room LG-187, McKnight Brain Institute
Thomas H. Mareci	thmareci@ufl.edu	(352) 273-5348	Room LG-183, McKnight Brain Institute
Robert McKenna	rmckenna@ufl.edu	(352) 294-8395	Room LG-179, McKnight Brain Institute
Matthew E. Merritt	matthewmerritt@ufl.edu	(352) 294-8397	Room R3-265, Academic Research Building
Daniel L. Purich	dlpurich@ufl.edu	(352) 294-8400	Room R3-265, Academic Research Building

**Office Hours:** Contact individual instructors to arrange office hours.

**Course Objectives:** BCH 6740 is a 3-hour course that presents the theoretical and practical aspects of structural biology and biophysical chemistry of biological molecules, and techniques for their study. The three 1-hour parts of this course are taught individually as BCH 6746 (Part A of BCH 6740), BCH 6747 (Part B of BCH 6740), and BCH 7515 (Part C of BCH 6740). Students taking all three parts should register for BCH 6740. The course will be of interest to graduate students and well-prepared undergraduates with interests in biochemistry, molecular and cellular biology, pharmacology, microbiology and cell science, chemistry, physics, plant sciences, and chemical engineering. Also this course constitutes one of the three core courses in the Department of Biochemistry and Molecular Biology.

**Prerequisites:** Students should have completed undergraduate courses in chemistry and physics, or the equivalent, and organic chemistry is highly recommended as preparation for this course. Calculus is used throughout, so students should have completed a course in calculus or the equivalent.

**Recommended textbooks and study materials:** Information about recommended textbooks and study materials is provided for each section of the course in the course schedules below.

### **BCH 6746; Structure of Biological Molecules**

This course provides detailed information about the basic elements of biological macromolecular structure with emphasis on current understanding the dynamics of protein folding, and protein-protein and protein-nucleic acid structure motifs.

Course Coordinator for BCH 6746: **Robert McKenna, Ph.D.**

### **BCH 6747; Biophysical Methods of Structure Determination and Hydrodynamic**

This course focuses on the application of biophysical techniques (circular dichroism, fluorescence, nuclear magnetic resonance, X-ray crystallography) used to determine the structure of biological macromolecules and biophysical techniques for determining macromolecular properties, including ultracentrifugation and mass spectroscopy, and methods of molecular separation. Also hydrodynamic approaches to understand molecular properties are presented, including molecular diffusion, viscosity.

Course Coordinator for BCH 6747: **Thomas H. Mareci, Ph.D.**

### **BCH 7515; Kinetics and Thermodynamics**

This course provides information about the fundamentals of chemical kinetics and thermodynamic analysis of equilibria. Emphasis is placed on the application of this knowledge to understanding basic enzyme kinetics, pulse-chase kinetics, protein polymerization, DNA dynamics, protein-nucleic acid interactions and cooperative ligand binding.

Course Coordinator for BCH 7515: **Daniel L. Purich, Ph.D.**

**Class Attendance, Preparation and Make-up Exams:** Class attendance is not required, but students who do not attend class will miss important discussion provided during the class period. Students should come to class prepared to interact and ask questions. **ABSENCE FROM SCHEDULED EXAMS IS STRONGLY DISCOURAGED.** Verifiable medical excuses are accepted and a make-up exam will be arranged.

**Grading:** The grade for each part [BCH 6740, Part A (BCH 6746); BCH 6740, Part B (BCH 6747); BCH 6740, Part C (BCH 7515)] is based on the test score for that section. There is no comprehensive final exam on Parts A, B & C. Overall grade for BCH 6740 is based on test scores for each section (Lowest score will be given one-half the weight of the two higher scores). Letter grades and grade points are assigned according to University policy (<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies>).

**Accommodations for Students with Disabilities:** Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

**Online Course Evaluation:** Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

## Campus Resources:

### Academic Resources

**E-learning technical support,** 352-392-4357 (select option 2) or e-mail to [Learningsupport@ufl.edu](mailto:Learningsupport@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>

**Library Support,** <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Student Complaints:** <https://ombuds.ufl.edu/student>

**Complaints Filing Options:** <https://hr.ufl.edu/manager-resources/employee-relations/employee-inquiry-and-complaint-procedures/complaint-filing-options/>

### Health and Wellness

Your well-being is important to the University of Florida. The U Matter, We Care initiative (<http://www.umatter.ufl.edu>) is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-294-CARE. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing Staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**U Matter, We Care** (<http://www.umatter.ufl.edu>): If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-294-CARE so that a team member can reach out to the student.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu>, 352-392-1575; and the University Police Department: 352-392-1111 or 9-1-1 for emergencies.

**Sexual Assault Recovery Services** Contact U Matter, We Care: ([http://www.umatter.ufl.edu/sexual\\_violence](http://www.umatter.ufl.edu/sexual_violence)) or Student Health Care Center, 352-392-1161.

**University Police Department,** 352-392-1111 (or 9-1-1 for emergencies).  
<http://www.police.ufl.edu/>

## Course Schedule

### Part A (BCH 6746: Structure of Biological Molecules)

Recommended Text: *Protein Structure and Function*, G. A. Petsko and D. Ringe,

Lecture	Day	Date	Lecturer	Title
L-1	M,	1/07	Long	Amino acids, chemistry and interactions
L-2	T,	1/08	Long	Protein Structure – Secondary and Dihedral Angles
L-3	W,	1/09	Long	Protein Structure – Tertiary Structure Patterns
L-4	F,	1/11	Long	Quaternary Structure: The Cytoskeleton
L-5	M,	1/14	Long	Membrane Proteins I
L-6	T,	1/15	Long	Membrane Proteins II
L-7	W,	1/16	Long	Protein folding – Basic concepts
L-8	F,	1/18	Long	Protein folding – current computational approaches

**Holiday --- Rev. Dr. Martin Luther King Jr. Memorial --- Monday, January 21**

L-9	T,	1/22	Long	Protein dynamics
L-10	W,	1/23	Long	Intrinsically disordered proteins, Part 1
L-11	F,	1/25	Long	Intrinsically disordered proteins, Part 2
L-12	M,	1/28	Long	Proteins and drug development
L-13	T,	1/29	Long	Protein engineering – designed proteins
L-14	W,	1/30	McKenna	Protein Structure: DNA Binding Proteins
L-15	F,	2/01	McKenna	Protein Structure: RNA Binding Proteins
L-16	M,	2/04	McKenna	Protein Structure: Viruses

**Review** W 2/06 All Instructors Review will cover L-1 through L-16

**Exam-1** M, 2/11 **BCH 6746 and Part A of BCH 6740**  
**McKnight Brain Institute, Room LG-101A**  
**Monday Evening, 6:00-8:00 pm**

### Part B (BCH 6747, Biophysical Methods of Structure Determination and Hydrodynamic)

Recommended textbooks: *Physical Biochemistry: Principles and Applications*, D. Sheehan  
*Biophysical Chemistry*, C. Cantor & P. R. Schimmel

Lecture	Day	Date	Lecturer	Title
L-17	W,	2/13	Bloom	UV/VIS Absorption Spectroscopy: Theory & Practice
L-18	F,	2/15	Bloom	UV/VIS Absorption Spectroscopy: & Circular Dichroism
L-19	M,	2/18	Bloom	Fluorescence Spectroscopy: Basic Theory
L-20	T,	2/19	Bloom	Fluorescence Spectroscopy: Polarization & Anisotropy
L-21	W,	2/20	Mareci	Molecular Size: Diffusion & Viscosity
L-22	F,	2/22	Mareci	Molecular Size: Light Scattering & Ultracentrifugation
L-23	M,	2/25	Mareci	Molecular Size: Gel Filtration, Electrophoresis & Mass Spec
L-24	T,	2/26	Merritt	NMR: Introduction to Nuclear Magnetic Resonance
L-25	W,	2/27	Merritt	NMR: Structure Determination and Backbone Assignment
L-26	F,	3/01	Merritt	NMR: Sidechains and Simulations

**SPRING BREAK --- March 4 - March 8**

L-27	M,	3/11	McKenna	X-Ray Crystallography: Principles & Techniques
L-28	T,	3/12	McKenna	X-Ray Crystallography: Principles & Techniques
L-29	W,	3/13	McKenna	X-Ray Crystallography: Active Sites
L-30	F,	3/15	McKenna	Cryo-EM: Principles & Experimental Design
L-31	M,	3/18	McKenna	Cryo-EM: Structure Analysis

**Review** W, 3/20 All Instructors Review will cover L-17 through L-31

**Exam-2** M, 3/25 **BCH 6747 and Part B of BCH 6740**  
**McKnight Brain Institute, Room LG-101A**  
**Monday Evening, 6:00-8:00 pm**

## **PART C (BCH 7515, KINETICS & THERMODYNAMICS)**

Study materials are provided free to all enrolled students.

<b>Lecture</b>	<b>Day</b>	<b>Date</b>	<b>Lecturer</b>	<b>Title</b>
L-32	W,	3/27	Purich	Chemical Kinetics: Measuring Reaction Rates
L-33	F,	3/29	Purich	Chemical Kinetics: Reaction Order, Molecularity, etc.
L-34	M,	4/01	Purich	Chemical Kinetics: Single- & Multi-Step Mechanisms
L-35	T,	4/02	Purich	Chemical Kinetics: Model (Data Analysis & Simulation)
L-36	W,	4/03	Purich	Basic Enzyme Kinetics: Assaying Reaction Rates
L-37	F,	4/05	Purich	Basic Enzyme Kinetics: One-Substrate Kinetics
L-38	M,	4/08	Purich	Basic Enzyme Kinetics: Multi-Substrate Kinetics
L-39	T,	4/09	Purich	Basic Enzyme Kinetics: Kinetic Isotope Effects
L-40	W,	4/10	Purich	Basic Enzyme Kinetics: Inhibitor Design
L-41	F,	4/12	Purich	Protein-Ligand Interactions: Allosterism & Cooperativity
L-42	M,	4/15	Purich	Protein-Ligand Interactions: Measuring Ligand Binding
L-43	T,	4/16	Purich	Biochemical Kinetics: Pulse-Chase Kinetics
L-44	W,	4/17	Purich	Biochemical Kinetics: Protein Polymerization Kinetics
L-45	F,	4/19	Purich	Biochemical Kinetics: Protein-Nucleic Acid Interactions
<b>Review</b>	M,	4/22	Purich	Review will cover L-32 through L-45
<b>Exam-3</b>	W,	4/24	<b>BCH 7515 and Part B of BCH 6740</b> <b>Health Science Center Communicore, Room C1-3</b> <b>Wednesday Evening, 6:00-8:00 pm</b>	