Course Syllabus – CHBIO 440

Course Information

Course Number: CHBIO 440 FA20
Course Name: Chemical Biology I
Term: Fall 2020
Start Date: 09/09/2020
End Date: 12/11/2020
Credits: 3.0

Meeting Days / Times

Mondays and Wednesdays, 9:45-11:15am PT / 12:45-2:15pm ET
(See Calendar in Canvas for the most up-to-date schedule.)

Location

Online via Zoom

Course Managers

Role	Last Name	First Name	Email Address
Course Director	Kelly	Jeff	jkelly@scripps.edu
Course Director	Powers	Evan	epowers@scripps.edu
TA	Garabedian	Brett	bgarabedian@scripps.edu
TA	Kline	Gabriel	gkline@scripps.edu

Course Description

This course is designed to give a broad overview of the fields of bioorganic chemistry and chemical biology. We discuss the structure and chemistry of the major classes of biomolecules (protein, nucleic acids, carbohydrates and lipids). We cover some modern methods of chemical biology, including evolutionary strategies in protein engineering, activity-based protein profiling, and mass-spectrometry-based proteomics. We also describe modern methods of drug discovery for both small molecule and biologic drugs.

Program Learning Outcomes

By the end of the program, students will have accomplished these objectives:
PLO1: Published research story.
PLO2: Generate creative approaches and methodologies for complex scientific questions.
PLO3: Master a potent set of technical research skills.
PLO4: Possess strong communication skills.

Course Learning Outcomes

By the end of this course, students will be able to:
CLO1: Understand the structure and chemistry of the major classes of biomolecules: proteins, nucleic acids, carbohydrates, and lipids.
CLO2: Understand the state of the art methods in chemical biology.
CLO3: Understand the basic aspects of drug discovery and development.

Background Preparation (Prerequisites)

Undergraduate level organic chemistry and biochemistry.

Course Materials

Required: Van Vranken & Weiss (2012). *Introduction to bioorganic chemistry and chemical biology*. ISBN: 978-0815342144.
Useful to consult: Voet & Voet (2010). *Biochemistry*. ISBN: 978-0470917459.
Useful to consult: Cantor & Schimmel (1980). *Biophysical chemistry: Part I: The conformation of biological macromolecules* . ISBN: 978-0716711889.
Useful to consult: Cantor & Schimmel (1980). *Biophysical chemistry: Part III: The behavior of biological macromolecules* . ISBN: 978-0-716711926.
Useful to consult: Walsh (1978). *Enzymatic reaction mechanisms*. ISBN: 978-0716700708.
Useful to consult: Branden & Tooze (1999). Introduction to protein structure. ISBN: 978-0815323051.
Useful to consult: Fersht (2017). *Structure and mechanism in protein science: A guide to enzyme catalysis and protein folding*. ISBN: 978-9813225190.
Useful to consult: Kuriyan, Konforti & Wemmer (2012). *The molecules of life: Physical and chemical principles*. ISBN: 978-0815341888.

Expectations and Logistics

Understanding how chemical principles can be applied to elucidate biological processes requires expertise in both chemistry and biology. Since this course is to serve primarily as a survey of bioorganic chemistry and chemical biology, we encourage students to learn more about specific topics by reading the primary literature. References will be provided for each of

the lectures, and we would be happy to provide further reading to those interested in specific topics.

Course Requirements

The midterm and final each constitute 50% of the final grade.

Attendance Statement

Attendance to all lectures is mandatory. The progression of lectures requires consistent attendance, as the course is designed to build on fundamental principles taught in previous lectures. Students are responsible for their own work and must have permission from the instructor if they must miss a class.

Scientific and Professional Ethics

The work you do in this course must be your own. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. You must explicitly acknowledge when your work builds on someone else's ideas, including ideas of classmates, professors, and authors you read. If you ever have questions about drawing the line between others' work and your own, ask the course professor who will give you clear guidance. Exams must be completed independently. Any collaboration on answers to exams, unless expressly permitted, may result in an automatic failing grade and possible expulsion from the Graduate Program.

Technology Requirements and Support

For issues related to Canvas, please contact the Graduate Office by email at: gradprgm@scripps.edu or by phone at: 858-784-8469.

Course Grading

Grading is in accordance with the academic policies of the Skaggs Graduate School. The breakdown of grading is as follows:

- Midterm Exam: 50%
- Final Exam: 50%

Grade Point	Letter Grade	
4.00	A	Outstanding achievement. Student performance demonstrates full command of the course subject matter and evinces a high level of originality and/or creativity that far surpasses course expectations.

3.67	A-	Excellent achievement. Student performance demonstrates thorough knowledge of the course subject matter and exceeds course expectations by completing all requirements in a superior manner.
3.33	B+	Very good work. Student performance demonstrates above-average comprehension of the course subject matter and exceeds course expectations on all tasks as defined in the course syllabus. There is notable insight and originality.
3.00	B	Satisfactory work. Student performance meets designated course expectations and demonstrates understanding of the course subject matter at an acceptable level.
2.67	B-	Marginal work. Student performance demonstrates incomplete understanding of course subject matter. There is limited perception and originality.
2.33	C+	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
2.00	C	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.
0.00	I	Incomplete is assigned when work is of passing quality but is incomplete for a pre-approved reason. Once an incomplete grade is assigned, it remains on student's permanent record until a grade is awarded.
0.00	P	Satisfactory work. Student performance demonstrated complete and adequate understanding of course subject matter. Course will count toward degree.
0.00	F	Unacceptable work/Failure. Student performance is unacceptably low level of knowledge and understanding of course subject matter. Course will not count toward degree. Student may continue in program only with permission of the Dean.
0.00	W	Withdrew from the course with Dean's permission beyond the second week of the term.

- All courses will be recorded and maintained in the student's permanent academic record; only courses that apply towards the degree will appear on the academic transcript. Non-credit or audited courses will not appear on the transcript.
- 4 core courses taken for a letter grade (pass = B- or higher for a core course)
- 2 elective courses taken pass/fail (pass = A, B, C for an elective)

Because students are encouraged to take electives outside their area of expertise, a "C" letter grade is passing.

Course Schedule:

Date	Details
Mon Sep 7, 2020	Labor Day (No Class)
Wed Sep 9, 2020	Forces Underpinning Molecular Recognition in Water (Kelly)
Fri Sep 11, 2020	Graduate Student Symposium (No Class)
Mon Sep 14, 2020	Protein Structure and Visualization (Forli)
Wed Sep 16, 2020	Chemical Synthesis of Proteins and PTMs (Dawson)
Mon Sep 21, 2020	Protein Folding in vitro, Pharmacologic Chaperoning (Kelly)
Wed Sep 23, 2020	Protein Folding in the Cell (Kelly)
Mon Sep 28, 2020	Nativley Unfolded Proteins (Deniz)
Wed Sep 30, 2020	Nucleic Acids in vitro (Powers)
Mon Oct 5, 2020	Nucleic Acids in vivo (Erb)
Wed Oct 7, 2020	Nucleic Acids Therapeutics (Powers)
Mon Oct 12, 2020	Bioorthogonal Chemistry (Carroll)
Wed Oct 14, 2020	Analysis of Ligand Binding (Powers)
Mon Oct 19, 2020	Midterm Exam
Wed Oct 21, 2020	Activity-based Proteomics (Parker)
Mon Oct 26, 2020	Protein Biologics and Bioconjugation (Rader)
Wed Oct 28, 2020	Intro to Enzymology (Lairson)
Mon Nov 2, 2020	Enzymes I (Renata)
Wed Nov 4, 2020	Enzymes II (Renata)
Mon Nov 9, 2020	Enzymes II Co-factors (Schultz)
Wed Nov 11, 2020	Carbohydrates I (Lairson)
Mon Nov 16, 2020	Carbohydrates II (Lairson)
Wed Nov 18, 2020	Evolution of Functional Macromolecules (Schultz)
Mon Nov 23, 2020	Biological Compartmentalization (Wiseman)
Thu Nov 26, 2020	Thanksgiving Holiday (No Class)
Fri Nov 27, 2020	Thanksgiving Holiday (No Class)
Mon Nov 30, 2020	Manipulating the Cellualr Proteome (Wiseman)
Wed Dec 2, 2020	Lipids and Membranes (Saghatelian)
Mon Dec 7, 2020	Final Exam