Biochemistry 704: Chemical Biology

• Spring 2010 •

Instructors: Laura Kiessling (kiessling@chem.wisc.edu) 471B Biochemistry Addition
Ron Raines (rtraines@wisc.edu) 371C Biochemistry Addition
Doug Weibel (weibel@biochem.wisc.edu) 471C Biochemistry Addition
Lectures: Tuesday and Thursday at 9:55 AM in 175 Biochemistry Addition

1	1/19	Kiessling	Information Flow in Chemistry and Biology
2	21	Raines	Biopolymer Synthesis
3	26	Raines	DNA Structure
4	28	Kiessling	DNA Recognition
5	2	Kiessling	DNA Recognition
6	4	Raines	RNA Structure and Folding
7	9	Raines	Transcription and its Modulation by Small Molecules; RNAi
8	11	Raines	RNA Aptamers; Ribozymes; Molecular Evolution
9	16	Raines	Translation and its Modulation by Small Molecules
10	18	Raines	Protein Folding and its Modulation by Small Molecules
11	23	Raines	Protein Stability and its Modulation by Small Molecules
12	25	Raines	Bioimaging
13	3/2	Kiessling	Chemical Genetics
14	4	Kiessling	Signal Transduction and its Modulation by Small Molecules
15	9	Raines	Chemoselective Reactions for Chemical Biology
16	11	Kiessling	Receptor–Ligand Engineering
17	16	Professor Anna Mapp (Michigan)	*Special Guest Lecture*
18	*18	Kiessling	Glycans & Multivalency
19	23	Raines	Directed Evolution
20	25	Raines	Directed Evolution
	30	SPRING BREAK	
	4/1	SPRING BREAK	
21	6	Professor Jason Gestwicki (Michigan)	*Special Guest Lecture*
22	8	Weibel	Secondary Metabolism: Non-Ribosomal Peptide Synthesis
23	13	Weibel	Secondary Metabolism: Polyketide Synthesis
24	**15	Raines	Enzymatic Catalysis—Principles, Concepts, Targets
25	20	Raines	Enzymatic Catalysis—Principles, Concepts, Targets
26	22	Raines	Enzymatic Catalysis—Principles, Concepts, Targets
27	27	Raines	Chemical Biology in Vitro *versus* in Cellulo
28	29	Raines	Chemical Biology in Vitro *versus* in Cellulo
	5/4	Research Proposal Reading Period	
	5/6	Research Proposal Reading Period	
29	TBA	Kiessling/Raines/Weibel	STUDY SECTION
30	TBA	Kiessling/Raines/Weibel	STUDY SECTION

***SPECIFIC AIMS DUE** ****RESEARCH PROPOSAL DUE**

Biochemistry 704: Chemical Biology

Course Description

Biochemistry 704: "Chemical Biology" is a 2-credit graduate-level course (30 sessions) on the use of ideas and methods of chemistry to solve problems in molecular and cell biology. The course is organized around the flow of information in biological systems, and emphasizes how chemists can intervene at each step, both to elucidate and control that flow. A major goal is to empower both chemists and biologists by providing chemists with relevant new targets and biologists with useful new tools.

Prerequisites

Successful completion of courses in organic chemistry (*e.g.*, Chemistry 343 *and* 345 at Wisconsin), biochemistry (*e.g.*, Biochemistry 501), physical chemistry (Chemistry 561 or 565) is assumed. You should already be able to answer questions such as

a. Draw the mechanism (using curved arrows to indicate electron flow) for the reaction of acetone and ammonia to form $CH_3–C(=NH)–CH_3$ (an imine or "Schiff base") and water.
b. Write the expression for the rate of product formation ($v = \partial[B]/\partial t$) during the chemical reaction:

$$A \xrightarrow{k_1} B$$

c. Draw the molecular structure of each natural amino acid and nucleobase.

If you are not familiar with the above material (especially, question a), you should not register for this course.

Grades

Grades will be based on in-class participation (20%), problem sets and quizzes (20%), an original research proposal (50%), which will be assessed during in-class "study sections", and reviews of two other research proposals during the in-class study sections (5% + 5%).

Texts

No text is required, but the following could be helpful references.

Alberts, B. et al. *Molecular Biology of the Cell*. Routledge (2007)
Blackburn, G. M. et al. *Nucleic Acids in Chemistry and Biology*. Royal Society of Chemistry (2006)
Frey, P. A. & Hegeman, A. D. *Enzymatic Reaction Mechanisms*. Oxford University (2006)
Grossman, R. B. *The Art of Writing Reasonable Organic Reaction Mechanisms*. Springer (2007)
Jencks, W. P. *Catalysis in Chemistry and Enzymology*. Dover (1987)
McMurry J. & Begley, T. *The Organic Chemistry of Biological Pathways*. Roberts & Co. (2005)
Miller, A. & Tanner, J. *Essentials of Chemical Biology*. Wiley (2008)
Stanforth, S. P. *Natural Product Chemistry at a Glance*. Blackwell (2006)
Voet, D. & Voet, J. G. *Biochemistry*. John Wiley & Sons (2004)

Website

www.biochem.wisc.edu/courses/biochem704/