

Meets Monday, Thursday 10:00-11:50AM J-ROWL 2C13

This course covers the theory and practice of X-ray crystallography and solution NMR spectroscopy of proteins, and many useful techniques for the biophysical characterization of proteins and their interactions.

-----**First half of course: NMR**-----

#	Date	Topic	Reading (Rule)	Homework
1	Mon, Aug 29	Overview: protein structure, NMR and chemical shift	1.1, 1.2, 1.5, 1.6	
2	Thu, Sept 1	Rotation, J-coupling, Decoupling	1.3, 7.1, 7.2, 7.4	
*	Mon, Sept 5	No class. Labor Day		
3	Thu, Sept 8	Dipolar Coupling and Relaxation	16, 19.1, 19.3	HW 1
4	Mon, Sept 12	NOE & NMR Instrumentation	16, 2.1	
5	Thu, Sept 15	NMR practice in Biotech NMR facility		HW 1 due
6	Mon, Sept 19	Spin echo, data processing and 2D	9, 10	
7	Thu, Sept 22	Product Operator formalism and COSY	6.3, 8	HW 2
8	Mon, Sept 26	2D Heteronuclear experiments	10	
9	Thu, Sept 29	3D experiments and backbone assignment	14.1-3	HW2 due
10	Mon, Oct 3	Sidechain assignment	14.4	
11	Thu, Oct 6	Protein structure determination	17	HW 3
12	Thu, Oct 13	(Monday schedule) Protein dynamics		
13	Mon, Oct. 17	Midterm exam (solution NMR)		HW 3 due

-----**2nd half of course: Xray crystallography**-----

#	Date	Topic	Reading (Rhodes)	Homework
14	Tue, Oct 11	Overview. Crystals. Symmetry.	Ch 2.1-2.6	HW4
15	Thu, Oct 20	The scattering of X-rays by electrons.	Ch 3, 5, 6.2	
16	Mon, Oct 24	--- no class ---		
17	Thu, Oct 27	Bragg's law. The Fourier transform.	Ch 4	HW4 due
18	Mon, Oct 31	Diffraction. The Reciprocal lattice.	Ch 4, 7.5.3	
19	Thu, Nov 3	Atomic scattering factors. B-factors.	Ch 6.3-6.3.2	HW5
20	Mon, Nov 7	Solving the phase problem. MIR & SIR.	Ch 6.3.3	
21	Thu, Nov 10	The Patterson function.	Ch 6.4	HW5 due
22	Mon, Nov 14	Anomalous scattering. MAD & SAD	Ch. 6.5-7.4	
23	Thu, Nov 17	Molecular replacement. Electron density.	Ch 7.5-8.2	HW6
24	Mon, Nov 21	Refinement.	Ch 7.7, 8.3	
*	Thu, Nov 24	No class; Thanksgiving holiday		

25	Mon, Nov 28	Exploring X-ray structures.		Download PyMol
26	Thu, Dec. 1	X-ray versus NMR structures		HW6 due
27	Mon, Dec. 5	Exploring X-ray structures.		
28	Thu, Dec. 8	Student presentations.		
	Finals week	Final Exam (X-ray crystallography)		

Instructors:

Chunyu Wang
276-3497
wangc5@rpi.edu
office location: Biotech 2229

Chris Bystroff
276-3185
bystrc@rpi.edu
office location: J-Rowl 3C07

Course web sites:

NMR: on webct, <http://rpilms.rpi.edu>

Crystallography: <http://www.bioinfo.rpi.edu/bystrc/courses/bcbp4870.html>

Course textbooks and materials:

First half of course:

Gordon Rule and T. Kevin Hitchens, "Fundamentals of Protein NMR Spectroscopy", Springer, 2006.

Second half of course:

Gale Rhodes "Crystallography Made Crystal Clear" Third Edition, Academic Press, 2006.

You will need a metric ruler, compass, protractor, graph paper and colored pencils.

GRADING:

First Exam	20%
Second Exam	20%
Project *	20%
Homework assignments (6)	30%
In-class quiz, class participation and attendance	10%

A single poor performance can not be dropped or weighed lower. The students may appeal the grades by presenting their case to the instructor.

ATTENDANCE POLICY. *Every two unexcused absences will result in a grade deduction of 0.33 with a maximum deduction of 1 whole grade.* *Every student will do an oral presentation in groups of two for the term project.

ACADEMIC DISHONESTY: Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your

collaboration. Submission of any assignment that is in violation of this policy will result in a penalty of an F for the course and the violation will be reported to the Dean of Students Office.. If you have any question concerning this policy before submitting an assignment.

Learning objectives

1. Students will be able to critically assess the quality of a protein structure as demonstrated by a poster or oral presentation.
2. Students will be able to demonstrate a thorough understanding of biophysical methods for protein structure determination by answering questions on an exam.
3. Students will be able to recall and explain the reasons behind steps in the experimental process of protein structure determination by answering questions on an exam.
4. Students will be able to interpret raw data from biophysical methods for protein structure determination by completing homework assignments..