BCBP 4870/6870 Protein Structure Determination Fall '20

Meets Monday, Thursday 10:10-12:00AM 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. 31	overview	1.1, 1.2, 2.1, 2.2	
2	Thu, Sept 3	NMR fundamentals	1.5, 1.6	HW 1
3	Tue, Sept. 8	Key concepts	7.1, 7.2, 7.4	
4	Thu, Sept. 10	FT and Relaxation	16.1, 16.2	HW 1 due
5	Mon, Sept. 14	NMR practice in Biotech NMR facility		
6	Thu, Sept. 17	Relaxation and couplings		HW 2
7	Mon, Sept. 21	NOE, COSY and TOCSY	10	
8	Thu, Sept. 24	Spin Echo and PO	14.1-3	HW2 due
9	Mon, Sept. 28	PO of J-coupling, HSQC	14.4	HW 3
10	Thu, Oct. 1	3D experiments and NMR assignment	17	HW 3 due
11	Mon, Oct. 5	NMR Structure determination		
12	Thu, Oct. 8	NMR Review		
	Mon, Oct. 12	no class		
13	Thu, Oct. 15	Midterm Exam		

——————————Second half of course: X-Ray ----------				
#	**Date**	**Topic**	**Reading (Rhodes)**	**Homework**
14	Mon, Oct. 19	Overview: crystals and symmetry		
15	Thu, Oct. 22	The scattering of X-rays by electrons.	Ch 3, 5, 6.2	Ex 1
16	Mon, Oct. 26	Bragg's law. Diffraction.	Ch 4, 7.5.3	Ex 2
17	Thu, Oct. 29	The Reciprocal lattice.	Ch 6.3-6.3.2	HW4 due

18	Mon, Nov. 2	Phasing. Isomorphous replacement.	Ch 6.3.3, 6.4	Ex 3
19	Thu, Nov. 5	Anomalous scattering.	Ch. 6.5-7.4	Ex 4
20	Mon, Nov. 9	Molecular replacement.	Ch 7.5-8.2	HW5 due
21	Thu, Nov. 12	Model building. Manual refinement.	Coot, Phenix	Ex 5
22	Mon, Nov. 16	Automated Refinement. B-factors.	Ch 7.7, 8.3	Ex 6
23	Thu, Nov. 19	Model validation.	MolProbity	Ex 7
24	Mon, Nov. 23	Crystal contacts.	Coot	Ex 8
	Thu, Nov. 26	Thanksgiving. No class.		
25	Thu, Nov. 30	Laue photography and MicroED	PDF	HW6 due
26	Mon, Dec. 3	review		
27	Thu, Dec. 7	student presentations		
28	Thu, Dec. 10	student presentations		
	TBD	Final exam		

Instructors:

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Course materials and web site: lms.rpi.edu

Gale Rhodes “Crystallography Made Crystal Clear” Third Edition, Academic Press, 2006.
Gordon Rule and T. Kevin Hitchens, “Fundamentals of Protein NMR Spectroscopy”, Springer, 2006.

GRADING:

First Exam	20%
Second Exam	20%
Project (oral presentation in groups of two*)	20%
Homework assignments (6)	30%
Quizzes, exercises, class participation and attendance	10%

A single poor performance cannot 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*.

GRADUATE COURSE: *Students enrolled in BCBP 6870 will do the term project on their own.

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.

COVID-19 related policy:

RPI is committed to the health and safety of all students. RPI will continue to monitor any new developments with COVID-19 and determine a course of action that will uphold the well-being of students while maintaining a quality educational experience.

Masks/Shields: *We know from existing data that wearing a mask in public can help prevent the spread of COVID-19 in the community. Rensselaer Polytechnic Institute has determined that everyone will be required to wear a face mask in all public spaces, including classrooms. You MUST wear a mask appropriately (i.e., covering both your mouth and nose) in the building if you are attending class in person. Masks have been provided for students, instructors, and staff, and everyone is expected to wear one. Students who choose not to wear a mask may not attend class in person. This is to protect their health and safety as well as the health and safety of their classmates, instructor, and the university community. Anyone attending class in person without a mask will be asked to put one on or leave.*

Instructors will end class if anyone present refuses to appropriately wear a mask for the duration of class. Students who refuse to wear masks appropriately or adhere to other stated requirements may face disciplinary action for Code of Conduct violations. Violations will be reported to the Dean of Students and violators will be requested to leave a classroom and return to their living quarters. The Dean of Students will provide the appropriate sanctions for the students per the code of conduct signed by the students.

Traffic Flow and Social Distancing*: Students and faculty will respect the need for social distancing to the degree possible by the setting.* Please maintain six feet of space while walking into and out of classes and enter and exiting the building.

Faculty and students will move in and out of the classroom as per the appropriate instructions of the faculty/administration. They are expected to follow printed traffic flow statements posted in all rooms and buildings.

In-Class Seating: Faculty are asked to assure that students sit in the appropriate designated seating in the classroom, using social distancing. Students are not allowed to move furniture or sit in seats not designated by the Institute.

Cleaning of Spaces: Students are encouraged to clean the surfaces of the chairs/tables/desks they occupy before they sit down and as they prepare to leave. Faculty should advise students to clean with their own personal wipes or cloths before and after class.

Student Health: On a case-by-case basis, students may consult with Student Disability Resources for accommodations if they cannot wear a mask. Students requiring such accommodations may be advised to take advantage of and participate in the course through remote learning. Students who are experiencing COVID-19 related symptoms should not attend class in person and are encouraged to contact a health care provider. *Students who are ill, under quarantine for COVID-19, or suspect they are ill will report that to Student Life. Student Life will verify and notify all faculty who have that student. Once notification is made, all faculty will make every reasonable effort to accommodate the student's absence and will communicate that accommodation directly to the student. Failure to make an appropriate accommodation for a verified or reasonably suspected case of illness may be appealable under the student grade appeal process. Students who need to report an illness should contact Office of the Dean of Student. They may also call: 518-276-6266.*

Refusal: Refusal to comply with any appropriate request will be treated as would any classroom disruption (request to change the behavior; request to leave the class; dismissal of the class and referral to Student Affairs.)