BIOMOLECULAR NMR SPECTROSCOPY

GRADUATE COURSE OFFERING IN NUCLEAR MAGNETIC RESONANCE

**Offered cooperatively by the Georgia State University,
the Georgia Institute of Technology, and the University of Georgia**

"Biomolecular Nuclear Magnetic Resonance" is a course intended for all graduate students with an interest in applications of nuclear magnetic resonance (NMR) to problems in structural and functional biology. It will begin with a treatment of the fundamentals that underlie magnetic resonance phenomena and develop this into a basis for experimental design, interpretation of data, and critical reading of the literature.

https://urbauerlab.uga.edu/8190

COURSE WEBSITE: HOME PAGE

https://urbauerlab.uga.edu/8190

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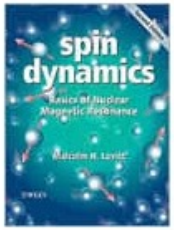
Biomolecular NMR

Nuclear Magnetic Resonance Spectroscopy of Biomolecules

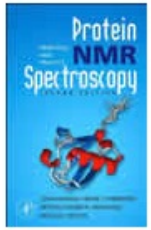
An Inter-University Course Offering from the University System of Georgia — Georgia Institute of Technology — Georgia State University — The University of Georgia

Syllabus



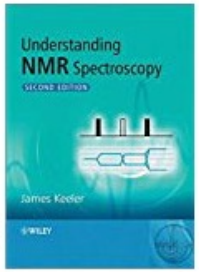
Main Text
Spin Dynamics – Basics of Nuclear Magnetic Resonance, 2nd Edition

Malcolm Levitt



Supplementary Text:
Protein NMR Spectroscopy, Principles and Practice, 2nd Edition

J. Cavanagh, W.J. Fairbrother, A.G. Palmer III, N.J. Skelton



Supplementary Text:
Understanding NMR Spectroscopy, 2nd Edition

James Keeler

The University of Georgia

BCMB/CHEM 8190
NMR Spectroscopy of Biomolecules

Lectures: see instructor for time and location

Lab Sessions: see instructor for time and location

Instructor:
Dr. Jeffrey Urbauer
urbauer@uga.edu

Georgia State University

CHEM 8540
Biomolecular Nuclear Magnetic Resonance

Lectures: see instructor for time and location

Lab Sessions: see instructor for time and location

Instructors:
Dr. Jenny Yang
Dr. Markus Germann

Georgia Tech

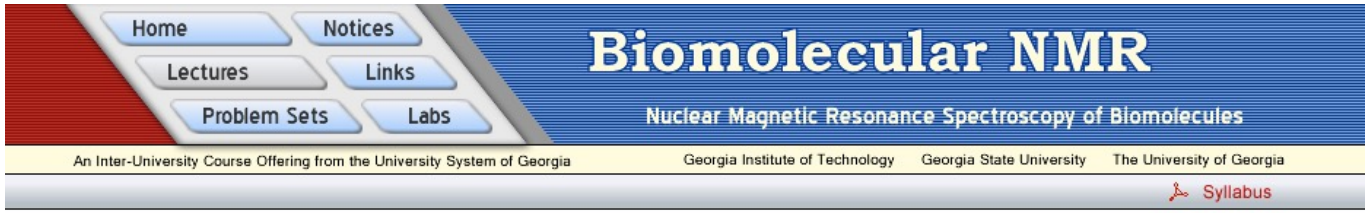
CHEM 8853R
Biomolecular NMR

Lectures: see instructor for time and location

Lab Sessions: see instructor for time and location

Instructor:
Dr. Les Gelbaum (Emeritus)

COURSE WEBSITE: LECTURES



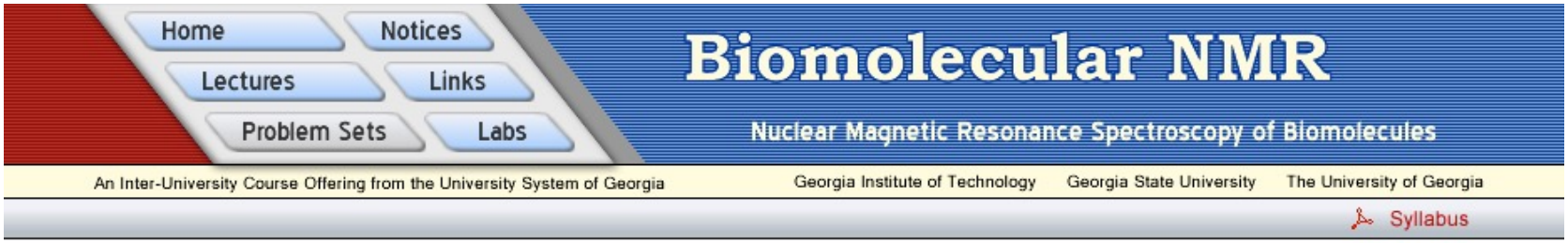
Lecture Schedule

Biomolecular NMR Spectroscopy - Spring 2022

Course Syllabus

Week	Instructor	Topic	Suggested Reading
			L – Levitt C – Cavanagh K – Keeler
I. Introduction			
1/10	Urbauer	Course organization, website, syllabus [video]	
1/12	Urbauer	Brief history of biomolecular NMR [video] Review of spin properties [video]	5 – 38 L
1/17		No Class: Martin Luther King Jr. Day	
1/19	Urbauer	RF pulses and spin relaxation - Bloch equations (precession video) [video of lecture]	39 – 50 L, 653 L
II. Instrumentation			
1/24	Urbauer	Instrumental considerations - a look at probes [video of lecture - part 1] [video of lecture - part 2]	65 – 76 L
1/26	Urbauer	Fourier transform methods and data processing [video of lecture - part 1] [video of lecture - part 2]	85 – 102 L, 78 – 101 K
III. NMR Observables – Classical and Quantum Descriptions			
1/31	Urbauer	Scalar Couplings [video of lecture]	217 – 223 L
2/2	Urbauer	Chemical Shifts [video of lecture - part 1]	195 – 206 L

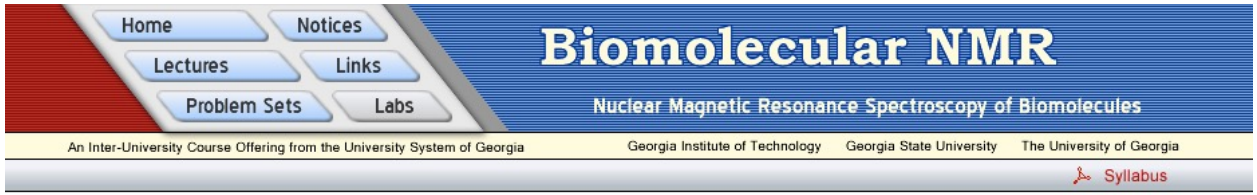
COURSE WEBSITE: PROBLEM SETS



Problem Sets & Exams

Q. - Questions	A. - Answers
Q. Problem Set 1	A. Problem Set 1
Q. Problem Set 2	A. Problem Set 2
Q. Problem Set 3	A. Problem Set 3
Q. Problem Set 4	A. Problem Set 4
Midterm 2017, no answers	Midterm 2017with answers
Q. Problem Set 5	A. Problem Set 5
Q. Problem Set 6.	A. Problem Set 6
Q. Problem Set 7.	A. Problem Set 7
Final 2017, no answers	Final 2017, with answers

COURSE WEBSITE: LABS



Laboratory Schedule

Date	Instructor	Topic
F 1/14	Urbauer	Computer Setup and Linux Tutorial (an older Linux Tutorial can be found here)
F 1/21	Urbauer	Classical Simulations of NMR Experiments with PjNMR Tutorial (older tutorials can be found here and here) Installing PjNMR
F 2/28	Urbauer	Intro to data processing, weighting functions - MNova (an older tutorial can be found here) [data] Installing the VNC viewer NMRBox - creating an account, logging in, transferring files
F 2/4	Urbauer	Data Processing and Analysis with NMRPipe in NMRBox (part 1) (a older tutorial can be found here) [data for part 1]
F 2/11	Urbauer	Data Processing and Analysis with NMRPipe in NMRBox (part 2) (an older tutorial can be found here) [data for part 2]
F 2/18	Urbauer	Maple (part 1): General mathematical and data analyses [lab exercise data and worksheets] Installing the Maple Share Library Maple Share Library (an old Maple tutorial can be found here, data is here)

COURSE ORGANIZATION: Lectures

- *Previously*, live, online lectures Mon. and Wed. (lab on Fri.)
  - asking questions during lecture cumbersome, non-interactive
  - lecturers struggled to cover material in lecture with questions
  - opportunities to ask questions were stymied
  - result was no (little) interaction between instructors/lecturers and students

- *New format*, pre-recorded lectures
  - students can view pre-recorded lectures any time
  - lectures can be viewed online or downloaded for offline viewing
  - in-person and online discussions each week so students can ask questions, get answers, review material/concepts, exchange ideas, get assistance with problems
  - students can also get help via email
  - the discussions can be scheduled for any time

COURSE ORGANIZATION: Labs

- *Previously*, in-person group lab sessions on Fri.
  - limited allotted lab time promoted rushing through tutorials
  - tutorials often not completed during allotted lab time
  - use of university computer labs limited access to computers
  - only university IT professionals allowed to install software, fix problems
  - little longer-term benefits to students from the labs

- *New format*, de-centralized computer lab
  - students use their own computers or computers in their research labs
  - students follow detailed tutorials for software installation and use
  - much of the software is part of the NMRBox resource, so does not need to be installed……students create an account and use the NMRBox servers to run the software
  - the advantages of the NMRBox resource are significant
  - students will find the NMRBox resource useful for their own research
  - students can work on the computer lab any time they want, and can work in groups or alone
  - an instructor will always be available to assist with the lab, and lab exercises can be discussed during weekly discussions

EXAMS and GRADING

- *Midterm exam*, scheduled mid-semester (see syllabus)
  - will cover all material covered up to the date of the exam
  - students will have a normal class time (50 minutes) to answer the exam
- *Final exam*, scheduled during the institutional allotted time
  - comprehensive: will cover all material covered during the semester
  - students will have three hours to answer the exam
- *Grading*,
  - the midterm exam counts for 25% of the overall course grade
  - the final exam counts for 75% of the overall course grade
- *Exam Format*, open book, open notes

All exams are open-book, open-note. Students can bring whatever books or notes they wish to exams. Each student should also bring a hand-held calculator to the exam periods, as a calculator will be necessary for answering some of the questions. Otherwise, NO other electronic devices are allowed during the exam (no laptops, no phones, no iWatches or equivalent, no iPads or equivalent, etcetera). Students can bring hard copies of lecture notes but will NOT have access to electronic copies during the exam. Students will NOT have access to the internet during exams. Students will NOT be allowed to retrieve additional materials during the exam.