Techniques of Biophysical Chemistry
MCB 4008 and 5008 - Spring 2023
11:15am - 12:05 pm Chemistry T309

Instructor
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Office Hours: By appointment

Course Description
Experimental biophysical research is heavily dependent on technical advances. This course surveys the techniques used in contemporary biophysics, with an emphasis on methods that probe the size, shape, and interactions of biological molecules. In addition to classroom lectures and discussions, we will visit laboratories for demonstrations of several biophysical instruments.

Topics
Overview of biophysical techniques
Treatment of experimental data
  Example: Ligand binding
  Linear data transformation vs. direct fitting
  Parameter estimation by nonlinear least squares fitting
Optical spectroscopy
  General Principles and Instrumentation
  Absorption Spectroscopy
  Fluorescence Spectroscopy
  Circular Dichroism
  Vibrational Spectroscopy
Light scattering
  Static light scattering
  Dynamic light scattering
Small angle scattering
  Small Angle X-ray Scattering
  Small Angle Neutron Scattering
Analytical ultracentrifugation
  Sedimentation Velocity
  Sedimentation Equilibrium
Isothermal titration calorimetry
Differential scanning calorimetry
Surface plasmon resonance
Atomic force microscopy
Microscale thermophoresis
Learning Objectives
At the end of the course students should be able to:
1. Explain how experimental errors can be distorted by data transformation.
2. Explain parameter estimation by nonlinear least squares fitting.
3. Draw block diagrams for the biophysical instruments covered in class.
4. Explain the principles governing the biophysical techniques covered in class.
5. Choose the most appropriate biophysical technique to answer a specific scientific question.

Text

Additional Background


Articles
Research and review articles as well as book chapters will be used to highlight specific areas. Materials available in electronic form will be placed on HuskyCT.

Course Evaluations
Exams: There will be two in-class exams and a final exam.
Problem Sets: Three problem sets will be assigned.

Final Project
Undergraduates will be given a research problem and asked to write a brief proposal describing how they would solve the problem using one of the biophysical techniques discussed in class. Graduate students will do an online presentation for the class using Blackboard Collaborate Ultra and write a review of an original research article which describes an application of one or more of the biophysical techniques described in class. All students are responsible for the material in the presentations.

Grades
Final grades will be calculated using the following weighting scheme:
Exams 65 %
Problem Sets 20 %
Final Project 15 %
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**Missed exams and late submission of assignments**

Make-up exams may be provided for students who provide a valid reason for missing a midterm and are only offered at the discretion of the instructor. Late assignments will only be accepted at the discretion of the instructor. The assignments may be marked down.

**Final Exam Policy**

In accordance with UConn policy, students are required to be available for their final exam and/or complete any assessment during the time stated. If you have a conflict with this time you must obtain official permission to schedule a make-up exam with the Dean of Students. If permission is granted, the Dean of Students will notify the instructor. Please note that vacations, previously purchased tickets or reservations, graduations, social events, misreading the assessment schedule, and oversleeping are not viable reasons for rescheduling a final.

**Accomodations for Illness or Extended Absences**

Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify your instructor as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with your instructor to determine how you will complete coursework during your absence.

If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at dos@uconn.edu to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.

COVID-19 Specific Information: People with COVID-19 have had a wide range of symptoms reported – ranging from mild symptoms to severe illness. These symptoms may appear 2-14 days after exposure to the virus and can include:

- Fever
- Cough
- Shortness of breath or difficulty breathing
- Chills
- Repeated shaking with chills
- Muscle pain
- Headache
- Sore throat
- New loss of taste or smell
Additional information including what to do if you test positive or you are informed through contract tracing that you were in contact with someone who tested positive, and answers to other important questions can be found here: [https://studenthealth.uconn.edu/updates-events/coronavirus/](https://studenthealth.uconn.edu/updates-events/coronavirus/)

**Standards, Policies and Resources**

As a member of the University of Connecticut student community, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. Review these important standards, policies and resources. Academic misconduct is dishonest or unethical academic behavior that includes, but is not limited to, misrepresenting mastery in an academic area (e.g., cheating), failing to properly credit information, research, or ideas to their rightful originators or representing such information, research, or ideas as your own (e.g., plagiarism).