

PHY332H5 – Molecular Biophysics

Description

A physicist's perspective on the building blocks of the living world, such as nucleic acids, proteins and lipids. The course will cover topics such as symmetry, structural complexity of the biological macromolecules, molecular interactions in the cellular environment and the impact for the biological function. Basic concepts from mechanics and thermodynamics will be applied specifically to proteins and DNA in order to understand structural transitions, stabilizing interactions, reaction dynamics and equilibrium. A rigorous treatment of a wide range of biophysical techniques commonly use in life science, such as optical spectroscopy, light scattering, mass spectrometry and single-molecule methods, will be accompanied by recent examples from biophysics research.

Prerequisite: PHY242H5, PHY255H5, JCP221H5

Instructor:

Claudiu Gradinaru, PhD
Associate Professor of Physics
Department of Chemical and Physical Sciences
Room DV4037
905-828-3833
claudiu.gradinaru@utoronto.ca
Office hours: Monday 3-4 pm or by appointment

Class Schedule:

Lectures: Wednesday, 10-12, DV 1146
Tutorials: Friday, 3-4 pm, DV 1109

Learning Objectives:

By the end of this course the students are expected to know how to apply Physics principles to understand the structure and the dynamics of biological systems, and to know how different optical techniques can be used to extract this information in a quantitative manner.

Course Syllabus:

1. Biological Macromolecules: conformations, configurations and symmetry.
2. Molecular Thermodynamics: molecular forces, energy, entropy and the stability of biological structures.
3. Biophysical Methods – theory and experiment:
 - absorption of light, photophysics
 - fluorescence spectroscopy
 - linear and circular dichroism
 - scattering techniques (light, X-ray, neutron)
 - single-molecule methods

Textbook:

Modern Biophysical Chemistry (2nd ed., 2014), by *P.J. Walla*

Evaluation Scheme:

Assignments (5 x 8%)	40%
Oral presentation of a biophysics research topic	20%
Final exam	40%

Lateness Penalties:

Late penalty on homework assignments: zero score once the deadline passed. Medical or other excuses will not be accepted as a reason for missing homework, which typically extends over several days (excepting, of course, in the unfortunate circumstance of a prolonged, serious illness). For the oral presentation, 50% of the mark if the presentation file is submitted within 24 hours after the due date/time, a mark of zero otherwise.

Issues associated with illness, pandemic or other absence:

1. Requests for special consideration due to absence can be submitted up to one week after an assignment deadline by 5pm of that day. Extension of this deadline will only be considered if the student is incapacitated past the one-week deadline. Within one week of the date of the missed work, students should submit to the course instructor a signed letter explaining the reason for their absence. The letter should include the student's name, phone number, email address, student number and lab/tutorial section number as well as the date of and the description of the missed work. A doctor's note or other appropriate documentation regarding the absence should be stapled to the letter.

If the explanation for the missed work is deemed reasonable after verification of the documentation, the final exam mark will be used as the mark for the missed work. If the explanation is considered unreasonable or no letter is submitted within one week of the missed work, a mark of zero will be assigned for the missed work.

2. Students must request special consideration by means of Email to the course instructor.

3. Supporting documentation required in addition to a ROSI absence declaration must be supplied in person. Absence due to illness requires a UofT medical certificate. All supporting documents will be examined to determine whether special consideration is granted.

In a circumstance such as an outbreak that affects many in the class, then alternatives in terms of lecture delivery, due dates and marking scheme will be arranged to support all members of the class.

Important Dates (Fall 2017):

Assignments' due dates (roughly):

- #1: 29 September
- #2: 18 October
- #3: 27 October
- #4: 10 November
- #5: 24 November

Oral presentation: 1 December, 3-5 pm, location TBA