

TIGP - CBMB

1122 Semester

Experimental Molecular Biophysics

實驗分子生物物理學

Time: 2:00 pm ~ 5:00 pm on Tuesdays

Place: R208 of the Institute of Biological Chemistry, Academia Sinica

Credit: 3 credits

Coordinator: Dr. Wei-Yuan Yang

Instructors:

Dr. Joseph Jen-Tse Huang (IoC), jthuang@gate.sinica.edu.tw

Dr. Su-Chang Lin (GRC), tomlin@gate.sinica.edu.tw

Dr. Wei-Yuan Yang (IBC), weiyang@gate.sinica.edu.tw

Dr. Hsin-Yung Yen (IBC), hsinyungyen@gate.sinica.edu.tw

TA: Ananay Sharma, sharma.ananay1997@gmail.com

Perspective:

A holy grail in biology is to modulate the functions of bio-molecules. For example, one wants to design small compounds to perturb the form and activities of bio-molecules for disease intervention (e.g., inhibition of protein aggregation for treating neurodegenerative diseases). These pursuits will not be possible without proper knowledge (e.g., structure, function, composition, interactome, localization) of the bio-molecules at hand. This course will give you a first-hand look at the many biophysical techniques that allow you to characterize your biomolecule of interest through lectures, facility visits, hands-on sessions, and designed presentations.

Grading scheme:

25% for each module (Details will be announced at each module)

- ◆ Topic A: Spectroscopy and Solution Biophysics
 - ◆ 15% in-class participation
 - ◆ 10% oral presentation
- ◆ Topic B: Imaging
 - ◆ 15% in-class participation
 - ◆ 5% quiz
 - ◆ 5% oral presentation
- ◆ Topic C: Crystallography
 1. Accomplishments in hands-on training and finish the oral presentation in the week 4: a max of 5 of final grade/week
 2. Responding to teacher's questions: a max of 1 of final grade/week

3. Hard worker or good results in hands-on training: a max of 1 of final grade
 4. No-shows get 3 of the final grade/week. (You will not have a second chance)
 5. COVID, RSV, or Flu positive (Please do not come. You need a proof.) get 5 of final grade for that week.
- ◆ Topic D: Mass Spec
 - ◆ Class participation: 15%
 - ◆ Presentation: 10%

Attendance:

Students who need to take leave should contact the course TA and the program secretary, Ms. Vicki Huang (vicki0315@gate.sinica.edu.tw) with proper reason and proof before the lecture starts. If not, will be considered an unexplained absence and may cause a deduction from the grade.

Schedule

Date	<p>Topic A: Spectroscopy and Solution Biophysics</p> <p>This module is to lecture on general spectroscopy techniques for peptides, proteins, and protein-protein interactions. The techniques to be covered include fluorescence, circular dichroism, infrared spectroscopy, fluorescence life-time imaging ...etc. Topics on protein misfolding and therapeutic strategies against protein misfolding will be introduced.</p>	Instructor
2/20	<p>A1: Principle of spectroscopy and protein misfolding (peptide synthesis, CD, fluorescence, and infrared spectroscopy)</p>	Dr. Joseph Jen-Tse Huang
2/27	<p>A2: Therapeutic strategies against protein misfolding (nanoparticle preparation, fluorescence life-time imaging, Fluorescence recovery after photobleaching)</p>	
3/5	<p>A3: Hands-on experiments (peptide synthesis, CD, fluorescence imaging)</p>	
3/12	<p>A4: Student Presentation (present related studies on protein misfolding or therapeutic strategy against protein misfolding diseases)</p>	
Date	<p>Topic B: Imaging</p> <p>This module will take you into the world of bio-imaging. We will help develop your intuition on bio-imaging, show you what microscopes there are on campus, and go through various imaging tricks that can help advance your research.</p>	Instructor
3/19	<p>B1: (A) Why imaging? (B) Contrast mechanisms.</p>	Dr. Wei Yuan Yang
3/26	<p>B2: (A) Resolution. (B) Intro to the many types of fluorescence microscopes (Hands-on session: using a confocal microscope).</p>	
4/2	<p>B3: (A) Optical-control of biomolecules. (B) Inside image quantification (Hands-on session: playing with ImageJ. //personal laptop required)</p>	
4/9	<p>B4: Case study: spatial biology- omics through imaging (in class quiz; short student presentations)</p>	

Date	Topic C: Crystallography This module is to lecture on the techniques for single-crystal X-ray diffraction and limitations. We will also use lysozyme as a model protein to go through the steps from protein crystallization to X-ray data collection.	Instructor
4/16	C1: Protein crystallization Hands-on training: Hanging-drop protein crystallization	Dr. Su-Chang Lin
4/23	C2: Why X-ray crystallography? Hands-on training: Crystal mounting	
4/30	C3: Principle of X-ray diffraction Hands-on training: Manual X-ray diffraction	
5/7	C4: How X-ray crystallography may help your research? (Student presentation)	
Date	Topic D: Mass Spec The goal of this module is to introduce the principle of mass spectrometry (MS) and the progress made in technological development. The application of MS for a range of biology/pharmaceutics studies and its emerging utility in investigating protein structures and dynamics will be further discussed.	Instructor
5/14	D1: History and basis of mass spectrometry	Dr. Hsin-Yung Yen
5/21	D2: The application of mass spectrometry in “mocs” studies (Hands-on session: Sample preparation for protein identification)	
5/28	D3: State-of-the-art mass spectrometry in investigating structural and dynamical property of protein molecules	
6/18	D4: Student presentation (Hands-on session: data analysis)	