Membrane Biophysics (3 credit)
Thursday Afternoon (2:20pm-5:30pm)

This is a graduate course for students wishing to learn the recent advance in membrane biophysics. It will cover 2 hrs lecture and 1 hr paper discussion and/or experimental practice. As can be seen in the following course outline, both the biophysical properties of model membrane system and the atomic/molecular basis of membrane pore formation will be covered to shed light on the important role of membrane conductance in life sciences. The course will be taught in English.

Tentative Schedule

Sep 17 Introduction to Biological Membranes (Ref I Ch10)
Sep 24 Synchrotron light sources and NSRRC site visit (MT Lee, NSRRC)
Oct 1 Properties of Lipids and model membrane (Ref II, Ch 1,2,3)
Oct 8 Introduction to Biological Spectroscopy (Ref III Ch 5, 6, 7)
Oct 15 Mid-term I
Oct 22 Membrane-active peptides and proteins (HW Huang)
Oct 29 Energetics and Phase behavior of lipid dispersions (HW Huang)
Nov 5 How to measure the physical property of a bilayer (HW Huang)
Nov 12 Membrane protein structure and function (Ref II Ch 5, 6, 7)
Nov 19 Mid-term II
Nov 26 Method of membrane experiment 1: NMR, ESR, IR Spectroscopy
-- membrane monolayer & lipid dispersion (Ref II, Ch 4, Ref III Ch 3,4)
Dec 3 Method of membrane experiment 2: Patch clamp, vesicle (HW Huang)
Dec 10 Method of membrane experiment 3: OCD (HW Huang)
Dec 17 Method of membrane experiment 4: GUV aspiration (HW Huang)
Dec 24 Method of membrane experiment 5: X-ray diffraction (HW huang)
Dec 31 Method of membrane experiment 6: Neutron diffraction (HW Huang)
Jan 7 Final Examination

Textbook & assigned reading:

I) Molecular Biology of THE CELL 2015 5th Ed. Alberts et al.
II) Membrane Structural Biology 2014 2nd Ed. Luckey, Cambridge. Univ.
III) Biological Spectroscopy 1984 ID Campbell & RA Dwek, Benjamn/Cummings Pubs.
IV) Spectroscopy for Biological Sciences 2005 GG Hammes J Willy & Sons

一、細胞膜上蛋白質與酯質及醣質的相互作用，尤其是膜上孔洞形成的物理機制研究是目前生命科學研究的一個重要課題，近年來的進展顯示結構生物及生物物理技術在細胞膜的應用研究扮演重要角色。但是，背景分為生物及物理兩個跨領域的學生，卻很難透過適當管道，進入此研究領域，本門課程乃針對此須求，並利用國內目前新成立的台灣光子源，來設計一個跨領域，研究生層級的課程，期望學生能在一個學期三學分的課程，學習到利用各種人工細胞膜，來重組蛋白在膜上的型態，以利各種生物物理技術的結構及功能研究。課程將開放給清華大學之外的研究生選修，亦可有到同步幅射中心實習的機會。
二、預期效益。
本課將開放給全台各校之研究生選修，並有機會透過實習及論文討論，讓學生能深入接觸同步幅射中心的設施，以利學生在修完本課後能進一步動手進行研究，達到國家教學及研究資源的充份利用。

期中考 Mid term I (30%); 期中考 Mid Term II(30%); 期末考 Final (40%)