A 3-Day Short Course on Introduction to Biophotonics

Dates: March 27, 28 and March 30, 2006
       (Monday, Tuesday and Thursday)
Time: 9:30 a.m.-12:30 p.m. and 2:30-5:30 p.m.

Lecture Room: EB2 (Engineering Building 2) Room 1109.

Contacts:
Prof. Aaron Ho (hpho@ee.cuhk.edu.hk)
Prof. Y. T. Zhang (ytzhang@ee.cuhk.edu.hk)
Prof. Chinlon Lin (chinlon@ie.cuhk.edu.hk)

Free for Graduate Students, Research Staff and Professors in the Field of Engineering, Science and Medicine who wish to broaden their knowledge into Biophotonics and Optoelectronics in Biomedical Engineering.

Registration: Class-size is limited; so first come first serve. Please send an e-mail with your name, institution, office phone number, e-mail and mailing address, by March 22, 2006, to Ms. Stella Yeung, EE Dept, CUHK, e-mail: sfyeung@ee.cuhk.edu.hk, tel: 2609-8370.

Short Course: Introduction to Biophotonics (18 hours, 6 hours per day)

Lecturer:
Professor Yin Yeh, Ph.D.
Associate Director for Science
NSF (National Science Foundation) Center for Biophotonics Science and Technology (CBST), University of California, Davis, California, USA

CBST: http://cbst.ucdavis.edu/about
Speaker Bio: attached below.

Topics
I. Introduction of Optical techniques:
   A. Fundamental interaction of light and matter
   B. Imaging at high resolutions – Optical microscope and beyond
   C. The need for quantum mechanical description of matter
D. Aspects of absorption/dispersion spectroscopy – ellipsometry, dichroism and birefringence
E. Scattering spectroscopy – elastic (diffraction) and quasi-elastic, Raman processes, imaging spectroscopy
F. Fluorescence spectroscopy – FCS, FRET, TIRF
G. Non-linear optical spectroscopy – SHG, SFG, SRS, CARS
H. Optical traps for molecular manipulation and force measurements.

II. **Structure and function relationship**
A. What are the driving forces for the formation of biologically significant molecules?
B. Is dynamics of the biomacromolecule a result of structural constraints? Or vise versa?

III. **Genomic properties - Sequence, structure and function of DNA**
A. Fluorescent labels with differential environmental responses.
B. Fluorescence in situ hybridization (FISH) and flow cytometry.

IV. **Manipulation of the DNA sequence**
A. Proteins that affect the replication process: Nuclease, helicase, topoisomerase, polymerase. Force measurements, level of twists in superhelices, ds-ssDNA.
B. Involvement of signaling in DNA repair mechanisms. Colocalization, dynamics of signal transduction (FCS).

V. **Membrane property I - Selective transport**
A. Lipid-protein interaction – protein conformations and dynamics of protein assemblies. (FRET).
B. Driving force of the membrane rafts: dynamic or static? (FRAP and FCS)
C. Measuring transmembrane flux – selective permeability or active transport?

VI. **Membrane property II – Recognition, adhesion and fusion**
A. Characterization of membrane diffusion – From lipids to proteins. (FCS)
B. Cellular signaling: Selectin and integrin; reactive signaling and secondary messengers. (FRET)
C. Identification of membrane receptors by structure and dynamics. (Non-tagging modalities - ellipsometry, CARS).

VII. **Enzyme properties I - Protein-protein interactions & supramolecular organization**
A. Aggregation structure and dynamics – building the extracellular matrix. (SFG, SHG)
B. Dynamics of proteins – translation, rotation and reaction. (DLS, FCS)
C. Colocalization and reactive stochiometry – At very close quarters. (FRET, Antibunching spectroscopy)

VIII. **Enzyme properties II - Motility and Contractility**
A. Assembly and disassembly of filaments for cytosis.
B. Force and step size in single molecule nucleotide utilization.
C. Structural and orientational dynamics of motor proteins.
Bio of Lecturer

Biography for Prof. Yin Yeh

Prof. Yin Yeh received his education at Massachusetts Institute of Technology (BS Physics, ‘60) and Columbia University (Ph.D. Physics, ‘65). He was a Post-doctoral Fellow both at the Columbia Radiation Laboratory and at Lawrence Livermore National Laboratory. He became a faculty member of the Department of Applied Science of the University of California at Davis in 1973 and rose to the position of Professor in 1978. He has also served as a consultant to NIH (National Institute of Health), LLNL (Lawrence Livermore National Lab.) Division of Biomedicine and the University of Texas Health Science System.

He was the recipient of the Roche Fellowship for a year at ETH (Federal Institute of Technology), Zurich, Switzerland, and the JSPS Senior Fellowship, for a period of study in Hokkaido, Japan. He is an External Examiner at Chinese University of Hong Kong, an Advisory Professor at East China Normal University of Shanghai, China, and recently had served as a Visiting Professor at National Yang Ming University in Taipei, Taiwan, ROC. Currently at University of California, Davis, Yeh serves as the Chair of the Designated Emphasis Program in Biophotonics, and is on the Executive Board of the Graduate Group in Biophysics. He is an Associate Director for Science and Technology for the NSF (National Science Foundation) Center for Biophotonics Science and Technology at UC Davis. His current research interest is focused on the role that dynamics of macromolecules plays in driving biophysical structure and functional relationship. Specific molecular systems include molecular motors, molecular and cellular signaling processes, and molecules that control biomineralization processes.