Cellular Biomechanics with Experiments (細胞力學與實驗) **Spring 2014**

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Office Hours: By appointment
Lecture: W5W6W7

Prerequisites
None, unless your background is not in engineering. If this is the case, then please come talk to me first for "Instructor Permission". In addition, a background in cell and molecular biology as well as mechanics will be helpful in this class (although not required).

Course Objectives
This course discusses how mechanical quantities and processes such as force, motion, and deformation influence cell behavior and function, with a focus on the connection between mechanics and biochemistry. Specific topics include: (1) the role of stresses in the cytoskeleton dynamics as related to cell growth, spreading, motility, and adhesion; (2) the generation of force and motion by moot molecules; (3) protein and DNA deformation; (4) mechanochemical coupling in signal transduction. If time permits, we will also cover protein trafficking and secretion and the effects of mechanical forces on gene expression. Emphasis is placed on the biomechanics issues at the cellular and molecular levels; their clinical and engineering implications are elucidated.

During this course we will introduce you to these subjects, train you to use them in real world applications, allow you to address a specific project, ask you to present and write about the project, and give you experience working as a team. We will also introduce how nanobiotechnology and microbiotechnology can be integrated with cellular and molecular mechanics (in areas such as BioMEMS) for understanding cell structure and mechanotransduction. We will integrate a laboratory experience with at least 2 specific hands-on labs during class so that students will get a true feel and understanding for cellular and molecular work.

Textbook N/A; class notes/journal papers/magazine articles

Grades
Report (assignment) (2) 20%; 200 words (in English)
Experiment 55%
Report & Presentation 25%; 1000 words (in English)

Tentative Schedule
Week 1-2 (2/19, 2/26): Why mechanics matters to biology and medicine?
Week 3-4 (3/5, 3/12): Mechanics versus biochemistry Report #1
Week 5-6 (3/19, 3/26): Cell movement and deformation
Week 7 (4/2): Cytoskeleton dynamics
Week 8 (4/9): Protein and DNA deformation Report #2
Week 9 (4/16): Presentation
Week 10-17: Experiments