

SEMESTER II

LSM4234 MECHANOBIOLOGY

Prerequisite: LSM2102 Molecular Biology and LSM2103 Cell Biology

Workload: 40 lecture hours

Course description:

This module introduces students to mechanobiology, an emerging field of life sciences that explores mechanical regulation and implications underlying numerous biological events from prokaryotes to higher organisms. It covers regulation of cell functions by cytoskeletal networks, mechanics of movement of tissue/cell/sub-cellular organelle, cellular/molecular force-sensing, mechanical modulation of biochemical signaling, physical landscapes of peri/trans/intra-nuclear events including transcription, and mechanical control of multicellular living organization. It also refers to physical and engineering aspects of physiological or pathological backgrounds of human health and diseases. In addition, students learn cutting-edge technologies to dissect mechanical/physical aspects of cellular/molecular functions.

S/N	Topics	Lecture hours
1	Overview of Mechanobiology	2h
2	Regulation of self-assembly of actin cytoskeleton (I)	2h
3	Regulation of self-assembly of actin cytoskeleton (II)	2h
4	Regulation and multiple functions of microtubule network	2h
5	Intermediate filaments and other cytoskeletal linkers	2h
6	Small G-proteins as major regulators of cytoskeleton	2h
7	Trafficking of intracellular organelles	2h
8	Cell division: Self-organization of mitotic spindle, Mitosis and cytokinesis	2h
9	Regulation of cytoskeleton in cell adhesion and migration	2h
10	CA	2h
11	Cytoskeleton-nucleus links	2h
12	Spatial organization of cell nucleus	2h
13	Chromosome assembly and function	2h
14	Mechano-feedback genetic circuits	2h
15	Cells as part of a tissue	2h
16	Mechanics of tissue morphogenesis	2h
17	Functional organization tissue patterning	2h
18	Cellular transmigration	2h
19	Cells and forces	2h
20	Concluding lecture	2h
Total Lectures: 40h		
Total hours:		40h

TEXT BOOK (Recommended text):

Molecular Biology of the Cell, 4th edition

Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter.
New York: Garland Science; 2002.

Cell Movement: From Molecules to Motility, 2nd Edition Dennis Bray. New York: Garland Science; 2000.

Physical Biology of the Cell

Rob Phillips, Jane Kondev, Julie Theriot, Hernan Garcia
New York: Garland Science; 2008.

MODE OF ASSESSMENT: CA 40%, Final Exam 60%

MODULE CO-ORDINATOR:

A/P Yusuke Toyama

(Tel: 6601-1273, E-mail: dbsty@nus.edu.sg)

LECTURERS:

Prof Alexander Bershadsky
A/P Yusuke Toyama

(E-mail: Alexander.Bershadsky@weizmann.ac.il)
(Email: dbsty@nus.edu.sg)