SEMESTER II

LSM4235 NUCLEAR MECHANICS AND GENOME REGULATION

Pre-requisite(s): LSM2102 Molecular Biology
Workload: 40 lecture hours + assignments
This module aims to develop an understanding of the relationship between physico-chemical constraints that underlie chromosome organization and its impact on regulating genetic information within the 3D nuclear architecture. In addition, mechanisms of nuclear mechanotransduction and its coupling to mechano feedback genetic circuits during differentiation, development and in diseases will be discussed.

S/N	Topics	Lecture hours
1	Introduction: Cellular organization of Genome Regulation	2
2	DNA Packaging: physico-chemical constraints	2
3	Histone modifications: euchromatin and heterochromatin assembly	2
4	Spatio-temporal dynamics of DNA packaging proteins	2
5	3D organization of chromosomes and transcription networks	2
6	Transcription dependent gene positioning & its clustering	2
7	Functional nuclear architecture & microrheology	2
8	Mechanical coupling between cytoskeleton & nucleus	2
9	Nuclear mechanotransduction: diffusion versus active transport	2
10	Impact of nuclear mechanics on DNA replication, damage and repair	2
11	Mechano-feedback genetic circuits	2
12	Stochastic processes in genome regulation	2
13	Plasticity of cell nucleus during differentiation	2
14	Emergence of functional nuclear architecture during development	2
15	Maintenance of cellular transcription memory through mitosis	2
16	Remodeling the cell nucleus during cell migration	2
17	Alteration in nuclear mechanics in diseases	2
18	Nuclear mechanics as a diagnostic biomarker	2
19	Genome regulation from bacteria to humans: evolutionary constraints	2
20	Summary: Nuclear mechanics and genome regulation	2
	Total lectures : **Assignments/preparations :**	**40h** **60h**
	Total hours:	**100h**

SUPPLEMENTARY READINGS:

- Molecular Biology of the Cell, 5th edition Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Garland Science; 2007.
- Molecular Biology of the Gene, 7th.Edition James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Benjamin Cummings, 2013.
- Physical Biology of the Cell Rob Phillips, Jane Kondev, Julie Theriot, Hernan Garcia Garland Science; 2008.

MODE OF ASSESSMENT:
30% short answer questions + 10% essays + 60% final exam

MODULE CO-ORDINATOR
A/ Prof G.V. Shivashankar (Tel: 651-2712; E-mail: dbsgvs@nus.edu.sg)