

SEMESTER I & II

LSM2232 – Genes, Genomes & Biomedical Implications

Prerequisite: LSM1102 (Molecular Genetics) and LSM1106 (Molecular Cell Biology)

Workload: 39 lecture hours + 6 tutorial hours + 5 CA and Discussion hours

This module deals with the structure, organization and function of genes and genomes in both prokaryotes and eukaryotes (e.g. DNA topology, hierarchy of packaging of DNA in chromosomes and relationship to gene activity and genome dynamics). The functional roles of DNA regulatory cis-elements and transcription factors involved in gene expression will be examined. The molecular events in the control and regulation of transcription; post-transcriptional modifications and RNA processing; temporal and spatial gene expression will be examined in detail. The cause and/or effect of dysfunction of gene expression in diseases will be discussed.

	Topics	Lecturers	
		Sem I	Sem II
1.	Gene structure-activity <ul style="list-style-type: none"> o Introduction - current trends and challenges in molecular biology o Genome editing (CRISPR-Cas) o Gene density; complexity and genome manipulation o Chromosomes <ul style="list-style-type: none"> - DNA topology, packaging & hierarchy of the eukaryotic genome - Nucleosomes; solenoids; loops; scaffolds; - Telomeres and centromeres - Satellite DNA; repetitive DNA elements; gene families ; transposons o Organelle genomes (mitochondrial genomes) 	THP 13	LBC 13
2.	Gene Expression and Regulation <ul style="list-style-type: none"> o Prokaryotic RNA polymerase and transcriptional regulation; Regulatory elements o Prokaryotic operons & regulatory circuits; o Positive & negative control systems; catabolic response, attenuation, antitermination o Mutations to identify functionalities of operator, regulator & repressor o Phage lambda life cycle and regulatory circuits o Gene transfer & genetic recombination: homologous, site-specific & transpositional recombination. o Mutation and DNA Repair o Epigenetics: Gene inactivation, Imprinting and Dosage compensation 	NL 13	DLW 13
3.	Eukaryotic Gene Expression and Regulation <ul style="list-style-type: none"> o Promoters; <i>cis</i>-elements (enhancers, silencers, LCRs...) in eukaryotes; o Eukaryotic RNA polymerases; transcription preinitiation complex; o Transcription factors (e.g. Zn fingers, homeodomains); Co-factors/Co-regulators; o Chromatin remodelling, Histone modification; o Post-transcriptional processing: 5'capping; splicing, polyadenylation, mis-splicing and diseases; o Differential gene expression (spatial and temporal); o RNA interference (RNAi) – gene silencing in control of expression o Translational control 	DJL 13	GZY 13
Total Lectures:		39	
Tutorials:		6	
CA and Discussion:		5	
Total hours		50 h	

MODE OF ASSESSMENT:

- CA1/Quiz (with MCQs) 15%
- CA2 (with SAQs) 25%
- Final (with MCQs) 60%

MODULE COORDINATOR: Ding Jeak Ling

LECTURERS: Semester I

Too Heng Phon (THP)
Norbert Lehming (NL)
Ding Jeak Ling (DJL)

Tel: 6516-3687,

Email: bchtoohp@nus.edu.sg

Tel: 6516-3499,

Email: micnl@nus.edu.sg

Tel: 6516-2776,

Email: dbsdjl@nus.edu.sg

Semester II

Low Boon Chuan (LBC)

Tel: 6516-4612,

Email: dbslowbc@nus.edu.sg

Deng Lih Wen (DLW)

Tel: 6516-1239,

Email: bchdlw@nus.edu.sg

Gong Zhi Yuan (GZY)

Tel: 6516-7202,

Email: dbsgzy@nus.edu.sg