

**SEMESTER I**  
**LSM3245 RNA BIOLOGY AND TECHNOLOGY**

**Prerequisite:** LSM2232

**Workload:** 26 lecture hours + 22 tutorial hours + 2 hours for 2 CA

**Course description:**

This module examines the roles of RNA, coding and in particular non-coding (ncRNA), in regulation of gene expression, host–pathogen interaction, and catalysis as well as their applications in research, diagnosis, and therapy of human diseases. The topics cover the ‘RNA world hypothesis’, the relation between structure and function of RNA, the mechanisms of regulation and dysregulation of gene expression by ncRNAs, selection and design of functional RNAs, features and usage of ncRNAs, the role of RNA in early stage pharmaceutical developments, and RNA-based drug development.

S/N	Topics	Lecture hours
1	<b>Introduction &amp; Coding RNA</b> <ul style="list-style-type: none"> <li>The RNA world hypothesis - Molecular unit of genotype and phenotype</li> <li>The role of RNA in gene expression</li> <li>Structure and function of RNA</li> </ul>	<b>4</b> VP
2	<b>Naturally occurring non-coding RNA</b> <ul style="list-style-type: none"> <li>Antisense RNA and ribozymes</li> <li>Circular RNA</li> <li>Bacterial Cas/CRISPR systems</li> <li>Bacterial riboswitches</li> <li>RNA interference: miRNA, siRNA, and piRNA</li> <li>Non-coding RNA and human diseases</li> </ul>	<b>8</b> VP
3	<b>Artificial non-coding RNA</b> <ul style="list-style-type: none"> <li>Selection and evolution of RNA: <i>in silico</i>, <i>in vitro</i> (SELEX), and <i>in vivo</i></li> <li>Aptamers and ‘Spiegelmers’</li> <li><i>In vitro</i> &amp; <i>in silico</i> selection of antisense RNA</li> <li>siRNA and shRNA design</li> <li>mRNA design for enhanced gene expression</li> <li>mRNA and miRNA as targets</li> <li>RNA-guided genome editing (CRISPR/Cas9)</li> <li>RNA splicing (<i>cis/trans</i>)-based therapeutic approaches</li> </ul>	<b>10</b> VP
4	<b>RNA in early stage pharmaceutical development</b> <ul style="list-style-type: none"> <li>RNAi-based screens for target discovery &amp; validation</li> <li>RNA-based diagnostics</li> <li>High-throughput technologies: Sequencing &amp; microarrays of RNA</li> </ul>	<b>6</b> VP 2  SC 2
5	<b>RNA as a drug – clinical applications</b> <ul style="list-style-type: none"> <li>Delivery and chemical modifications of RNA</li> <li>Clinical Trials, FDA approval, and RNA-based drugs</li> </ul>	<b>2</b> VP
Total lectures :		30h
Tutorials :		18h
CA :		2h
<b>Total hours :</b>		<b>50h</b>

**TEXT BOOK:**

Life’s Indispensable Molecule, James Darnell, 1<sup>st</sup> Ed. (2011), CSH Laboratory Press (from US\$ 40), optional  
RNA Worlds, Atkins, Gesteland, Cech (2011), CSH Laboratory Press (US\$ 146), optional

**MODE OF ASSESSMENT:**

40% Continuous Assessment: 1 Mid-term exam (MCQ quiz) and 1 literature review (each 20%)  
60% Final Examination: MCQ and SAQ

**MODULE CO-ORDINATOR:**

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