

ABS-838 RNA BIOLOGY 3-0

Educational Objectives

1. This course aims to provide participants with a comprehensive introduction to RNA as a vital macro-molecule and the independent research going on in the field of RNA biology. For students with an interest in Molecular biology, regulatory biology, gene expression/regulation and non-coding genomes, it is the best opportunity to enhance their skills with latest knowledge for their professional development. Alongside different practical courses will be conducted to strengthen concepts of the students in understanding the novel techniques and their use in the advanced research areas of biology.

2. Course Outcomes

- a. The early “RNA world” hypothesis
- b. History and Chemistry of RNA
- c. RNA in the control of information flow
- d. RNA-catalyzed RNA replication
- e. **RNA as independent genome**
- f. Single/double stranded RNA viruses
- g. RNA plasmids
- h. **RNA stability**
- i. Roles of structure and sequence in stability
- j. RNA destruction paths
- k. The degradosome, Spliceosome and Exosome
- l. multiple activities in RNA degradation and composition of total RNome
- m. RNA as Regulators
- n. Why RNAs are recruited as regulators instead of proteins?
- o. RNA as *Cis*-regulators
- p. RNA thermometer
- q. **CRISPR-Cas System**
- r. **Riboswitches**
- s. *Cis*-encoded base-pairing sRNAs

- t. RNA as *Trans*-regulators
- u. Negative regulation
- v. **Positive regulation**
- w. **Long non-coding RNAs (lncRNA)**
- x. Introduction to RNomics
- y. The early days of RNomics
- z. “Omics” approaches
- aa. Computational RNomics
- bb. comparative genomics, structure conservation, Promotor/terminator searches, open reading frame, Ribosome binding site (RBS)
- cc. Secondary structure prediction: two methods: Minimum free energy (based on empirical data) – mfold, statistical folding – Sfold
- dd. Functional RNomics
- ee. Northern Blotting, Microarray, Quantitative PCR, RNA Fluorescent, In Situ Hybridization; RNA Sequencing, cDNA libraries
- ff. **microRNA (miRNA) and small interfering RNA (siRNA)**
- gg. Origins and context, role in cellular mechanisms
- hh. Double-stranded RNA, Dicer, siRNA and RNA-induced silencing complexes.
- ii. Artificial ncRNAs: aptamers and SELEX

3. **Recommended books**

- a. The Molecular Biology of RNA, 2010, Oxford University Press, by David Elliot, Prof. of Genetics, Newcastle University UK.
- b. RNA Worlds: From Life’s Origins to Diversity in Gene Regulation, 2011, Edited by John F. Atkins, *University of Utah, USA*.