

BTY426:CELL AND MOLECULAR BIOLOGY

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

- CO1 :: enumerate the universal features of cell and its organelle
- CO2 :: discuss the mechanism behind intra-cellular trafficking and cell cycle regulation
- CO3 :: articulate the principle behind DNA replication, repair, recombination.
- CO4 :: outline processes of transcription, RNA processing, translation, and post-translational modifications.
- CO5 :: summarize regulatory mechanisms of gene expression, gene silencing, and chromatin remodeling.
- CO6 :: justify role of epigenetic modifications in gene regulation and disease.

Unit I

Cellular organization : Universal features of cells, cell chemistry and biosynthesis - chemical organization of cells, internal organization of the cell - cell membranes: structure of cell membranes and concepts related to compartmentalization in eukaryotic cells

Cytoskeleton and Function of intracellular organelles : Structure and organization of cytoskeleton, Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility

Unit II

Cellular Transport and trafficking : Molecular mechanisms of membrane transport, nuclear transport, transport across mitochondria and chloroplasts, intracellular vesicular trafficking from endoplasmic reticulum through Golgi apparatus to lysosomes/cell exterior

Cell cycle and its regulation : mitosis, meiosis and cytokinesis

Unit III

Structure and Properties of Nucleic Acids : Types and structure of DNA, denaturation and re-naturation of DNA, supercoiling of DNA, types and structures of RNA

Hierarchical Packaging of DNA : histone proteins, the nucleosome assembly

DNA Replication : enzymes and proteins in DNA replication, DNA replication in prokaryotes, DNA replication in eukaryotes, fidelity of DNA replication, rolling circle replication

Unit IV

DNA Repair Mechanisms : molecular characterization of repair enzymes in direct repair, single strand damage repair, repair of double strand DNA breaks

Homologous Recombination : homologous and site-specific recombination, models for homologous recombination- the holliday Model, RecBCD pathways, conserved site-specific recombination, Cre/LoxP recombination

Unit V

RNA synthesis and processing : transcription in prokaryotes, transcription in eukaryotes, antibiotic inhibitors of transcription, Post-Transcriptional Modifications -capping, RNA splicing, polyadenylation

Protein Synthesis and Processing : protein synthesis in prokaryotes, protein synthesis in eukaryotes, inhibitors of translation, post translational modifications (PTMs)- chemical modifications, proteolytic cleavage, protein splicing

Unit VI

Regulation of Transcription in Prokaryotes : operon models, riboswitches, bacteriophage lambdaA transcriptional switch

Regulation of Transcription in Eukaryotes : covalent histone modifications, nucleosome remodelling, DNA methylation and gene regulation

Mechanism of Gene Silencing : RNA interference- RISC-mediated silencing, mechanisms of RNA interference, role of heterochromatin in gene silencing

Epigenetic Regulation : epigenetics and the environment, epigenetics and cancer

Text Books:

1. CELL AND MOLECULAR BIOLOGY by DONALD E. BIANCHI AND PHILIP SHEELER, WILEY

References:

1. LEWIN'S GENES XII by JOCELYN E. KREBS, ELLIOTT S. GOLDSTEIN, ELLIOTT S. GOLDSTEIN, JONES & BARTLETT LEARNING