division, cell cycle and regulation: Mitosis and meiosis, phases of cell cycle. Cell necrosis and programmed cell death. Techniques in cell biology: Visualization of cells and sub cellular components by light microscopy, microscopy of living cells, resolving powers of different microscopes, scanning and transmission electron microscopy, confocal microscopy and atomic force microscopy.

Unit II **14 hrs.**

Bio-membranes: Physicochemical properties of biological membranes; compositions, supra molecular organization. Models of membrane; Singer and Nicholson's model, Newer models. Membrane asymmetry; lipids, proteins and carbohydrates and their lateral diffusion. Membrane domains; caveolae, rafts, membrane lipid and protein turnover, intracellular targeting of proteins. Membrane transport: Simple diffusion, facilitated diffusion and active transport. Glucose transporters, Ca2+ ATPase, Na+ -K+ ATPase (Structure and mechanism of action). Endocytosis, receptor mediated endocytosis, exocytosis, ion channels; gated and non-gated, aquaporin channel.

Unit III **14 hrs**

Mechanism of hormone action: Peptide hormones: General mechanisms of cell signaling by hydrophilic factors, transmembrane receptors, transmembrane receptors, G protein coupled receptors, receptor tyrosine kinase. **Second messengers:** 1P3, DAG, cAMP, protein kinases. Nitric oxide signaling; generation and action. **Growth factors:** Structure, mechanism of action and receptors of EGF, PDGF, NGF and IGF. Insulin receptor. Receptor down regulation, desensitization and up regulation.

Unit IV **14 hrs.**

Mechanism of action of steroid hormones: Conversion of cholesterol to steroid hormone. Steroid receptors, isolation and characterization of steroid receptors. Chemistry and action of prostaglandins, prostacyclins and thromoxanes, eicosanoid receptors. Newly discovered hormones. Insect **hormones:** Structure and function of moulting hormone, ecdysone, juvenile hormones, Pheromones. Application of insect hormones, plant hormones.

Course outcome:

- The student would understand the organization of cell and their components and division of cell.
- Various microscopic techniques used for visualizing different types and stages of cells and sub-organelle structure
- Mechanism of transportation of nutrients and other molecules against the membrane.
- Conduction of nerve impulse and transmission of signal to various cells

REFERENCES:

1. The Cell: A Molecular Approach, Cooper and Hausman
2. Molecular Biology of The Cell, Bruce Alberts
3. Molecular Cell Biology, Lodish, Berk *et al.*,

BCS 504: MOLECULAR GENETICS: SOFT CORE

Lecture hours: 42 **Total Credits: 03**

Course objectives

- To study the basic principles of genetics, gene linkage and X-linked inheritance and cytoplasmic inheritance
- To study the organization of chromosomes in prokaryotes and eukaryotes
- Causes of mutation and repair mechanism

29/01/2020

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• Various diseases associated with anomalies in chromosome number and structure.

Unit I **14 hrs.**

Basic Principles of Mendelism- Laws of Inheritance, dominance, codominance, epistasis, (eg., Comb shape in chicken) Pleiotropism. Cytoplasmic inheritances (eg. Male sterility in plants, Shell Coiling). **Gene Linkage and Chromosome-** Linkage and recombination of genes in a chromosome. Crossing over gene mapping with three -point test cross. X-linked inheritance. Polygenic inheritance, mitochondrial inheritance, Y-chromosome inheritance.

Unit II **14 hrs.**

Organization of Genes in Prokaryotic and Eukaryotic Chromosome-Genome size and evolutionary complexity, C-value paradox, structure of bacterial chromosome, structure and organization of eukaryotic chromosome, nucleosome organization, arrangement of chromatin fibers in a chromosome, Polytene chromosomes, Centromere and telomere structure,Karyotype, Epigenetic modifications on chromatin

Unit III **14 hrs.**

Molecular Genetics- Mutations-nature of Mutations, spontaneous and induced mutation, conditional, lethal (eg. Temperature sensitive) mutation. Biochemical basis of mutation. Point mutation, base substitution mutation, missense, nonsense and silent mutation. Mutation rates. Chemical mutagens, radiation induced mutation, reverse mutations and suppressor mutations- intergenic and intragenic suppression, reversion as a means of detecting mutagens- Ame's test. **Repair Mechanism-** Reciprocal recombination, site specific recombination, *E.coli* rec system. Holliday model of recombination. **Chromosomal Basis of Human Diseases-** Extra or missing chromosome, abnormality in chromosome structure – deletion duplication, inversion, translocation

Course outcome

• The student understands the basic principles of genetics, gene linkage and X-linked inheritance and cytoplasm inheritance

• Various causes of mutation and their repair mechanism

• Diseases associated with changes in chromosome number and structure.

REFERENCES:

1. Genetics, Strick Berger, M.W. (1990) 3rd edn. McMillan.
2. Human Molecular Genetics; Peter Sudbery, (2002) Printice Hall.
3. Introduction to Genetics: A Molecular Approach; T A Brown, Garland Science (2011).
4. Molecular Biology of the Cell; 7th Edn. Bruce Alberts et al., Garland Publications (2008).
5. Human Genetics; Lewis, 7th Edn. WCB & McGraw Hill (2007).
6. Molecular Cell Biology; Lodish et al., 7th Edn. W.H. Freeman and Co. (2012).
7. Essential Genetics: A Genomics Perspective; Daniel L. Hartl, 6th Edition, Jones and BarlettLearning (2012).

29/04/2020

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