Subject Code : P8ZO2

CORE COURSE II - GENETICS AND EVOLUTION
A. GENETICS

Unit-I

Mechanism of Inheritance and Gene Regulation

Phage – Genetic material, mechanism of recombination and concept of lysogeny.

Bacteria – Genetic material – chromosomal and extra- chromosomal - Mechanism of recombination by transduction, transformation and conjugation- Mapping of bacterial chromosomes.

Eukaryotes – Genetic fine structure – Cistron, muton, recon, exon, intron, Mechanism of homologous recombination. Role of recombinase and chromosome mapping.

Regulation of gene expression – *Lac* and tryphophan operon of bacteria. Short term and long term regulation of eukaryotic gene with reference to steroid hormone stimulation of gene, expression of globin gene family.

Unit-II

Population, Mutation and Cancer Genetics

Genes in populations – allelic and gene frequencies – implications of Hardy-Weinberg principle – Factors affecting Hardy-Weinberg equilibrium.

Gene mutations – Chromosomal and point mutations, spontaneous and inducible mutations, reversible and suppressor mutations. Mutagens – Physical, chemical and biological. Teratogens and induced birth defects.

Carcinogens – Genetic basis of cancer – Chromosomal translocations – Role of oncogenes and tumour suppressor genes – RB genes and P_{53}.

Unit-III

Human Genetics

Inborn errors of metabolism: disorders of amino acid metabolism – PKU, alkaptonuria and albinism; disorders of purine metabolism – Lesh-Nhyan syndrome and ADA deficiency; disorders of carbohydrate metabolism – galactosemia and G_6PD deficiency; disorders of lipid metabolism – Tay Sach's diease and Gaucher's disease.

Haemoglobin disorders – Sickle cell anemia and thalassemia.
Human Karyotype preparation and chromosomal syndromes in man – Down, Turner and Kleinfelter syndromes.

B. EVOLUTION

Unit IV

Present status of the concept of natural selection – genetical theory of natural selection – evidences for the role of natural selection
Neo – Lamarckism – present concept of recapitulation – genetic and non-genetic variations – origin and evolutionary significance.

Polymorphism and selection – definitions, transient polymorphism, balanced polymorphism, genetic polymorphism, enzyme polymorphism and selection advantages.

Unit V

Polyploidy and evolution – genetic assimilation – genetic speciation – species concept – evolutionary trends – canalization of selection – orthoselection.

Molecular evolution – gene evolution, evolution of gene families, molecular drive, assessment of molecular variation, punctuated equilibria and neutrality theory.

Molecular phylogenies and evolution – immunologic techniques, amino acid sequences, DNA sequences, nucleic acid phylogenies based on DNA-DNA hybridization and restriction enzymes, combined nucleic acid – amino acid phylogenies – rate of molecular change, molecular clock, regulatory genes and evolution.

Evolution of population – from races to species, adaptation pattern, behavioural adaptations and strategies, sexual competition and selection, isolating mechanisms, mode of speciation and evolutionary rate

Recommended Text Books

GENETICS

1. JENKINS, J.B. (1983), Human Genetics, The Benjamin Cummings Publishing Co.
2. URSULA GOODENOUGH (1984), Genetics, Saunders College Publishing Co., London.

References

GENETICS

1. BENJAMIN LEWIN (2000), Genes VII, Oxford University Press, New York.
2. DANIEL L. HARTL (1994), Genetics, III Ed., Jones and Bartlett Publishers, Boston.
3. JOHN D. HAWKINS (1996), Gene Structure and Expression, III Ed., Cambridge University Press.

4. ROBERT H. TAMARIN (1996), Principles of Genetics, WCB Publishers. Munro.W. Also,
www.catchword.com

www.fruitfly.org

Evolution

Recommended Text Books

Evolution

STRICKBERGER, M.W. (1996). Evolution. Jones and Barlett publishers Inc., London.

DOBZHANSKY, T., AYALA, F.J., STEBBINS, G.L. and VALENTINE, J.W. (1975). Evolution. Surjeet Publications.

.

References

DODSON, E.O. and DODSON, P. (1976). Evolution : Process and Product (II Edn), Van Nostrand Company, New York.

DOWDESWELL, W.H. (1963). The Mechanism of Evolution, Arnold-Heinmann India, Delhi.

JOHA, A.P. (1992). Gene and evolution, The Macmillan Co., New Delhi.

MERREL, D.P. (1962). Evolution and Genetics : The Modern theory of Evolution. Holt, Rinehart and Winston Inc., New York.