

Title: Code: Zol-507. General and Molecular Genetics 4(3-1)**Course Objectives:**

1. To prepare the students to understand General and Molecular Genetics to understand Mendelian and non-Mendelian pattern of inheritance in human and to understand the terms and basic concepts of genetics, chromosomes and genes, traits and variations in changing environment, how traits are inherited, analyses (to solve problems and complete pedigrees) and how genetic problems may lead to disease or lethality and current issues regarding genetics e.g., cloning etc.
2. To impart knowledge about chemical, physical and biological properties of nucleic acids.
2. To understand different molecular mechanisms and their regulation in prokaryotes and eukaryotes.

Learning Outcomes

The students will be able to achieve the aims and objectives of this course; on completion of course will be able to define terms of genetics and apply concepts of modern transmission, Solve transmission genetics problems, make accurate predictions about inheritance of genetic traits as well as make predictions about the causes and effects of changes in DNA, practice common genetics laboratory techniques and techniques of modern genetic technology, as well as select the correct techniques to solve practical genetic problems and identify the human traits and genetic diseases

Course Outline

1. Nucleic acid, structure and Significance of genetic material.
2. DNA structure
Structure of DNA –A, B and Z forms.
3. DNA replication mechanisms in prokaryotes, Proofreading and role of different enzymes
DNA replication in eukaryotes
DNA polymerases and other enzymes and DNA binding proteins involved in DNA replication
DNA Damaging agents
DNA repair mechanisms.
4. Cell Cycle and its regulation.
5. Transcription in prokaryotes, different RNA polymerases and their role transcriptional control in prokaryotes. Transcription in eukaryotes and role of different enzymes
Post-transcriptional processing of mRNA, rRNA and tRNA.
6. Genetic Code, genetic code in mitochondrial DNA
7. Translation: Protein synthesis in Prokaryotes

Translation in eukaryotes

Post-translational processing of proteins

Regulation of Gene Expression: Inducible and repressive operons

Lac Operon and Trp Operon

8. Recombinant DNA technology: Restriction enzymes

Cloning vectors. PUC and PBR322, viral vectors, cosmid etc

Restriction and Ligation

Transformation and Expression

9. Polymerase chain reaction

DNA Hybridization techniques southern blotting, Northern blotting western blotting

DNA sequencing (Introduction to Sanger's method)

10. Site directed mutagenesis. Cancer genomics, Introduction Oncogenes, Introduction, types and mode of action.

Practical

1. Preparation of different stock solutions used in molecular biology (solution used in PCR, electrophoresis, DNA isolation, RNA isolation and Protein isolation).
2. Isolation of DNA from human blood.
3. Quantification of DNA and RNA through spectrophotometer.
4. DNA amplification through polymerase chain reaction.
5. Separation of different sized DNA fragments on agarose gel.

Books Recommended

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. 2017. Molecular Biology of the Cell. 6th Edition. Garland Publishing Inc., New York.
2. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. Martin. 2016. Molecular Cell Biology. W. H. Freeman Publishers, Scientific American Inc.
3. Geoffrey M.C., Robert E.H. 2007. The cell: A Molecular Approach, Sinauer Associates, INC.
4. Karp, J. 2005. Cell and Molecular Biology, Concepts and Experiments, John Wiley and Sons, INC.
5. De Robertis, E. D. P. 2017. Cell and Molecular Biology, 8th edition, Lea & Febiger, New York.