

Educational Objectives:

1. To provide information about basic genetic mechanisms
2. To provide information on techniques used to manipulate living cells and overview genetic engineering methods
3. To discuss the exploitation of basic molecular biology knowledge to genetically engineer living organisms to provide services or products

Course Outcomes:

4. The student must be able to relate the rules of biochemistry and molecular biology to GE and use that knowledge to manipulate macromolecules like DNA, RNA and proteins.
5. Be able to explore the advantages of genetic manipulations that could benefit humankind.
6. Be able to use this powerful tool of genetic manipulation ethically and morally.
7. Must appreciate the fact that this knowledge is required by humankind to fight disease and to overcome food shortage.

Course Contents:

8. **Molecular Biology Methods**
 - a. Introduction
 - b. Purification of nucleic acids
 - c. Manipulation of Nucleic Acids in vitro
 - (1) DNA restriction and ligation
 - (2) Restriction mapping
 - (3) DNA Modification

- (4) Synthesis and degradation of nucleic acids
- (5) Nucleic acid amplification
- (6) Polymerase chain reaction (PCR)
- (7) Identification of specific sequences
- d. Analysis of nucleic acids
 - (1) Gel Electrophoresis
 - (2) Hybridization
 - (3) Sequencing
- e. Introduction to cloning
- f. Genetic Manipulation in Prokaryotes (*E. coli*)
- g. Cloning vectors in prokaryotes
 - (1) Plasmid vectors
 - (2) Viral vectors (lambda phage derivatives)
 - (3) Cosmids
 - (4) M13 derivatives
- h. Introduction of genetic information in bacteria
 - (1) Transformation and Transfection
- i. Detection and identification of a clone
 - (1) Selection of recombinants
 - (2) Screening of clones
- j. Genomic libraries, cDNA libraries
- k. Genetic Manipulation in Eukaryotes
 - (1) Genetic manipulation in yeasts
 - (2) Eukaryotic expression vectors
- l. Gene expression analysis
 - (1) Purification of proteins
 - (2) Proteins analysis using ELISA

- (3) Electrophoresis
- (4) Hybridization (Immunoblotting)

9. **Cellular techniques**

- a. Bacterial culture
- b. In-vitro cell culture
- c. Analysis of cells
 - (1) Microscopy
 - (2) FACS

Recommended Books:

- 1. Genetic Engineering by D.S.T. Nicholl.
- 2. Gene cloning and manipulation by Christopher Howe.
- 3. Diagnostic Techniques in Genetics by Jean-Louis Serre.
- 4. [Genetic techniques for biological research: a case study approach](#) by Corinne V. Anthony Michels.
- 5. *Research techniques [in biochemistry and](#) molecular biology* by Robert E. Thach, Mary R. Newburger.
- 6. Biotechnology: Applying the Genetic Revolution by David P. Clark, Nanette J. Pazdernik.