Bot.SP-15 ADVANCES IN MOLECULAR GENETICS Credit Hours: 3(2+1)

THEORY
Introduction of the Course

This course work is designed to highlight autonomous replicating entities, DNA Integrity, Protection and Repair and Homologous Genetic Recombination.

Course Objectives

1. To introduce advance genetic engineering techniques to the students
2. To enable the students to understand various DNA manipulations at the molecular level

Contents

1. **Autonomous Replicating Genetics Entities:** Plasmid Replication and Maintenance, Plasmid Replication, different Mechanisms of Regulation of Plasmid Replication, Genes involved in Stable Maintenance. Plasmid Born Functions, Transfer Function, Resistances to Antibiotics and Toxic Ions, Bacteriocin and Toxin Production, Plasmid Involvement in Host Metabolism. Nomenclature of Plasmids and Plasmid Born Functions.
2. **Protection DNA Integrity, DNA Methylation and the Restriction Modification System:** Restriction-Modification Phenomenon.Discovery.General Features of DNA Methylation.The Host Specificity of DNA (Hsd) Systems. The Methylated-Adenine (Mar or Mrr) and Methylated Cystosine (Mcr) Restriction System of *E.Coli.*Other Modification and/or Restriction System. The DNA Adenine-Methylation (Dam) and DNA Cystosine-Methylation (Dcm) Systems. Restriction-Modification and Evolution.
3. **DNA Repair:** Classification of Repairable Lesions. Direct Repair. Base Excision Repair.Nucleotide-Excision Repair. Recombinational (or post replication) Repair. Cross-Link Repair. Mismatch Repair. Inducible Repair.

Practicals:

1. Transformation
2. Conjugation
3. Mutagenesis
4. Plasmid DNA Preparations (Mini Preps)
5. Agarose Gel Electrophoresis
6. Molecular Markers

Teaching-Learning Strategies

1. Lectures
2. Group Discussion
3. Laboratory work
4. Seminar/ Workshop

Learning Outcome:

1. Students are expected to get themselves familiarized with the molecular/macromolecular organization of plant cells and DNA in general.
2. They should be able to understand almost infinite possibilities of structural organization, molecular backbones and the myriad roles or functions they can take or perform.
3. Students should be able to understand the basic concepts with regard to DNA Amplification by PCR.

Assessment Strategies:

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Recommended Readings:

1. Gardner, E.J. (2004). *Principles of Genetics*, John Willey and Sons, New York.
2. Glick, B.R. and Pasternak, J.J. (2003). *Molecular Biotechnology.* ASM Press Washington DC.
3. Pierca, B.A. (2005). *Genetics*; *A Conceptual Approach.* W. H. Freeman and Company, New York.
4. Primrose, S.B., and Twyman, R.M. (2006). *Principles of Gene Manipulation and Genomics.* Blackwell Scientific Publications.

5. Primrose, S.B., Twyman, R.M. and Old R.W. (2004). *Principles of Gene Manipulation, an Introduction to Genetic Engineering*. (6th Ed.), Blackwell Scientific Publications.
6. Snustad, D.P. and Simmons, M. J., (2005). *Principles of Genetics*,(4th Ed.). John-Wiley and Son Limited.
7. Synder, L, and Champness, W. (2004). *Molecular Genetics of Bacteria.* ASM Press, Washington D.C
8. Wilson, J. and Hunt, T. (2004). *Molecular Biology of the Cell* – The Problems Book. Garland Publishing Inc.

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