Molecular Genetics No. = 0501217

Credit Hours = 3

Time : Sun., Tues., Thursday 11-12

Lecturer : Dr. Nabil Amer ( M.D., Ph.D.)

Recommended Text Books :

1. Concepts of Genetics 10th.Ed.

 William S. Klug, Michael R. Cummings,

 Charlotte A. Spencer & Michael A. Palladino

 Publisher :PEARSON 2012

1. Essentials of Genetics 7th. Ed. 2010( Same Authors & Publisher)

**Course Description and Objectives:**

Objectives of this course are designed to understand the basic principles of molecular Biology and Molecular Genetics. Emphasis will be given to those principles that have application in medical practice. The structure of DNA and RNA as genetic material, DNA organization and its replication, mutation and repair in both prokaryotes and eukaryotes will be covered. Furthermore, gene expression will also be discussed. Finally, the course will cover some aspects of cancer genetics, cytogenetics and molecular biology techniques.

Molecular genetics is one of the most rapidly advancing fields of medicine and is now integral to all aspects of biomedical science. Every physician who practices in the 21st century will require a basic knowledge of the principles of molecular genetics and their application to a wide variety of clinical problems.

The practice of modern medicine includes recognition of the role of genetic factors in health and disease. This requires knowledge of the structure, function, and transmission of genes and understanding of interactions both among genes, and between genes and the environment.

The following outline lists the objectives of the course material in Molecular medical genetics.

Students in Molecular genetics at BAU should know and understand:

1.What are genes and how they are organized.

2.How genes are arranged in chromosomes and how chromosomes replicate.

1. How genes are transmitted from parent to child, how genes segregate, and the patterns of inheritance for dominant and recessive, autosomal and X-linked traits.
2. The nature of mutations and how they are repaired, and how they contribute to human variability and disease.
3. What genes do: the flow of genetic information from DNA to RNA to protein?
4. How gene expression is controlled.
5. The significance of the Human Genome Project to medicine.
6. The molecular basis of inherited disease.
7. The role of genetics in the pathogenesis of neoplasms and in the predisposition to malignancies.
8. The multifactorial nature of most human traits and the principles of multifactorial inheritance.
9. The clinical manifestations of the common chromosomal anomalies.
10. Common molecular and cytogenetic diagnostic techniques and how they are applied to genetic disorders

**Detailed Sallabus :**

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| **No.Of Lectures** | **Day & Date** | **Topic** | **Lecture Outlines** |
| 1 | Sun 27/1 | Introduction | 1.Definition of molecular genetics2. Integration of molecular genetics to other sciences3. Clinical goals of molecular genetics4. Outlines of syllabus being selected |
| 2 | Tues. 29/1 | DNA Structure | 1.What is the structural unit of DNA build up2.Describing double helix structure3.Mentioning the importance of DNA strandcomplementation4.Supercoiled DNA as a tertiary structure |
| 3+4 | Thurs 31/1Sun 3/2 | DNA Replication | 1.Central dogma for transfer of genetic information2.Semiconservative DNA replication3.Mechanisms of DNA replication4.Differences between prokaryotic and eukaryotic DNA replication5.Special replication of telomere ends |
| 5 +6 | Tues 5/2Thurs. 7/2 | DNA RecombinationTechnology | 1.The role of restriction enzymes in recombinant DNA2.Behavior of 2 different genes at different positions on the same chromosome3.Gene density4.Types of Satellite DNA5.Recombinant DNA technology6.Specific steps of cloning7.Genomic libraries8.Choice of an *E. coli* host |
| 7 | Sun 10/2 | DNA repair | 1.Outlines types of DNA damages2.Human DNA repair systems against chemicaland UV damages3.Xeroderma pigmintosum genetic variants with defect in dimmers excision repair |
| 8 | Tues 12/2 | Types of RNA | 1.Structure of transfer RNA2.Ribosomal RNA as structural component of the ribosome3.Function of messenger RNA as carrier ofgenetic information |
| 9+10 | Thurs 14/2Sun 17/2 | Gene expression | 1.RNA transcription in prokaryotes2.RNA transcription in eukaryotes |
| 11 | Tues 19/2 | Protein synthesis | 1.General properties of the genetic codes2.Mechanism of RNA translation in prokaryotes3.Antibiotics that act as specific inhibitors ofprokaryotic RNA translation4.RNA processing in eukaryotes5.Differences between RNA translation of prokaryotes and eukaryotes |
| 12 | Thurs 21/2 | Genotype and Phenotype | 1. Description of human genotype2. Comparison of human genotype with bacterial genotype3. Packaging of DNA in chromatin and chromosome forms4. Evidence that DNA is the genetic material |
| 13 | Sun 24/2 | The Gene | 1. Explaining the gene arrangement and locations on the chromosome2. What is the gene action?3.Differences in structure between prokaryoticand eukaryotic genes4. Arrangement of gene families5.Behavior of the gene during meiosis |
| 14 | Tues 26/2 | The chromosomes | 1.Chromosome structure2. Position of alleles on chromosomes3.Mentioning the behavior of linked genes duringmeiosis |
| 15+16 | Thurs 28/3Sun 3/3Tues 5/3 | Regulation of gene expression | 1.Lac operon as a model of gene regulation inprokaryotes2.Glucose catabolite repression of other metabolite inProkaryotes3.Positive activation of gene regulation in eukaryotes4.Chromatin remodeling in facilitating geneexpression5.Role of activators in tissue selection duringdifferentiation6.Steroid hormone receptors as gene activators7.Post-transational control of protein formation |
| 17 | Thurs 7/3 | Mutation | 1.Germ line verses somatic mutation2.Types of point mutations3.Chromosomal mutations4.Conditional mutations |
| 18 +19 | Sun &Tues  | Revision |  |
|  | Sunday17/3 | MID-Term Exam  | 9-11 ( 50 % of total grades , 50 MCQs ) |
| 20 | Tuesday19/3 | Exam Feedback |  |
| 21 | Thursday 21/3 | Introduction to genetics | Mendelian principles of heredity biologyMendels law of segregation monohybrid cross |
| 22+23 | Sunday 24/3Tuesday 26/3 | Gene identification | 1. Probing of the gene with complementary labeled sequence2.Explaining the technique of DNA blottingSouthern BlotNorthern blot3.DNA sequencing |
| 24 | Thurs. 28/3 | The Human Genome Project | 1.Goals of the human genome project2.Sequencing the human genome |
| 25+26 | Sund. 31/3Tuesd. 2 /4 | Types of congenital diseases | I. Monogenic disordersAutosomalo Recessiveo DominantSex linked2. Polygenic disorders |
| 27+28 | Thurs. 4/4Sund 7/4 | Clinical implications ofMolecular genetics | 1.DNA fingerprinting in forensic medicine2.Use of repetitive sequence length polymorphism inthe diagnosis of congenital diseases |
| 29 +30 | Tues 9/4Thurs. 11/4 | Methods of gene transfer to human chromosome | 1.*ex vivo* technique2*.in vivo* technique3.Gene transfer vehicle |
| 31 | Sund.14/4 | Gene therapy | 1. Types of gene therapy2. Gene therapy attempts for cystic fibrosis3. Gene therapy attempts for Duchenne muscular dystrophy |
| 32 | Tues.16/4 | Stem Cell Therapy | Knowing the source & the techniques of stem cell therapy |
| 33+ 34 +35 | Thurs 18/4 Sund.21/4Tuesd. 23/4  | EXTRA | 1.Epigenetics 2.Applications & Ethics of genetic engineering &Biotechnology. 3. Genetics & Behavior. |
| 36 + 37  | Thurs. &Sunday25/4 -28/4 | Revision Sessions | Questions & Video sessions |