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 genetics  2. Integration of molecular genetics to other sciences  3. Clinical goals of molecular genetics  4. Outlines of syllabus being selected |
| 2 | Tues. 29/1 | DNA Structure | 1.What is the structural unit of DNA build up  2.Describing double helix structure  3.Mentioning the importance of DNA strand  complementation  4.Supercoiled DNA as a tertiary structure |
| 3+4 | Thurs 31/1  Sun 3/2 | DNA Replication | 1.Central dogma for transfer of genetic information  2.Semiconservative DNA replication  3.Mechanisms of DNA replication  4.Differences between prokaryotic and eukaryotic DNA replication  5.Special replication of telomere ends |
| 5 +6 | Tues 5/2  Thurs. 7/2 | DNA Recombination  Technology | 1.The role of restriction enzymes in recombinant DNA  2.Behavior of 2 different genes at different positions on the same chromosome  3.Gene density  4.Types of Satellite DNA  5.Recombinant DNA technology  6.Specific steps of cloning  7.Genomic libraries  8.Choice of an *E. coli* host |
| 7 | Sun 10/2 | DNA repair | 1.Outlines types of DNA damages  2.Human DNA repair systems against chemical  and UV damages  3.Xeroderma pigmintosum genetic variants with defect in dimmers excision repair |
| 8 | Tues 12/2 | Types of RNA | 1.Structure of transfer RNA  2.Ribosomal RNA as structural component of the ribosome  3.Function of messenger RNA as carrier of  genetic information |
| 9+10 | Thurs 14/2  Sun 17/2 | Gene expression | 1.RNA transcription in prokaryotes  2.RNA transcription in eukaryotes |
| 11 | Tues 19/2 | Protein synthesis | 1.General properties of the genetic codes  2.Mechanism of RNA translation in prokaryotes  3.Antibiotics that act as specific inhibitors of  prokaryotic RNA translation  4.RNA processing in eukaryotes  5.Differences between RNA translation of prokaryotes and eukaryotes |
| 12 | Thurs 21/2 | Genotype and Phenotype | 1. Description of human genotype  2. Comparison of human genotype with bacterial genotype  3. Packaging of DNA in chromatin and  chromosome forms  4. Evidence that DNA is the genetic material |
| 13 | Sun 24/2 | The Gene | 1. Explaining the gene arrangement and locations on the chromosome  2. What is the gene action?  3.Differences in structure between prokaryotic  and eukaryotic genes  4. Arrangement of gene families  5.Behavior of the gene during meiosis |
| 14 | Tues 26/2 | The chromosomes | 1.Chromosome structure  2. Position of alleles on chromosomes  3.Mentioning the behavior of linked genes during  meiosis |
| 15+16 | Thurs 28/3  Sun 3/3  Tues 5/3 | Regulation of gene expression | 1.Lac operon as a model of gene regulation in  prokaryotes  2.Glucose catabolite repression of other metabolite in  Prokaryotes  3.Positive activation of gene regulation in eukaryotes  4.Chromatin remodeling in facilitating gene  expression  5.Role of activators in tissue selection during  differentiation  6.Steroid hormone receptors as gene activators  7.Post-transational control of protein formation |
| 17 | Thurs 7/3 | Mutation | 1.Germ line verses somatic mutation  2.Types of point mutations  3.Chromosomal mutations  4.Conditional mutations |
| 18 +19 | Sun &Tues | Revision |  |
|  | Sunday  17/3 | 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 biology  Mendels law of segregation monohybrid cross |
| 22+23 | Sunday 24/3  Tuesday 26/3 | Gene identification | 1. Probing of the gene with complementary labeled sequence  2.Explaining the technique of DNA blotting  Southern Blot  Northern blot  3.DNA sequencing |
| 24 | Thurs. 28/3 | The Human  Genome Project | 1.Goals of the human genome project  2.Sequencing the human genome |
| 25+26 | Sund. 31/3  Tuesd. 2 /4 | Types of congenital diseases | I. Monogenic disorders  Autosomal  o Recessive  o Dominant  Sex linked  2. Polygenic disorders |
| 27+28 | Thurs. 4/4  Sund 7/4 | Clinical implications of  Molecular genetics | 1.DNA fingerprinting in forensic medicine  2.Use of repetitive sequence length polymorphism in  the diagnosis of congenital diseases |
| 29 +30 | Tues 9/4  Thurs. 11/4 | Methods of gene transfer to human chromosome | 1.*ex vivo* technique  2*.in vivo* technique  3.Gene transfer vehicle |
| 31 | Sund.14/4 | Gene therapy | 1. Types of gene therapy  2. Gene therapy attempts for cystic fibrosis  3. 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.21/4  Tuesd. 23/4 | EXTRA | 1.Epigenetics  2.Applications & Ethics of genetic engineering &  Biotechnology.  3. Genetics & Behavior. |
| 36 + 37 | Thurs. &Sunday  25/4 -28/4 | Revision Sessions | Questions & Video sessions |