

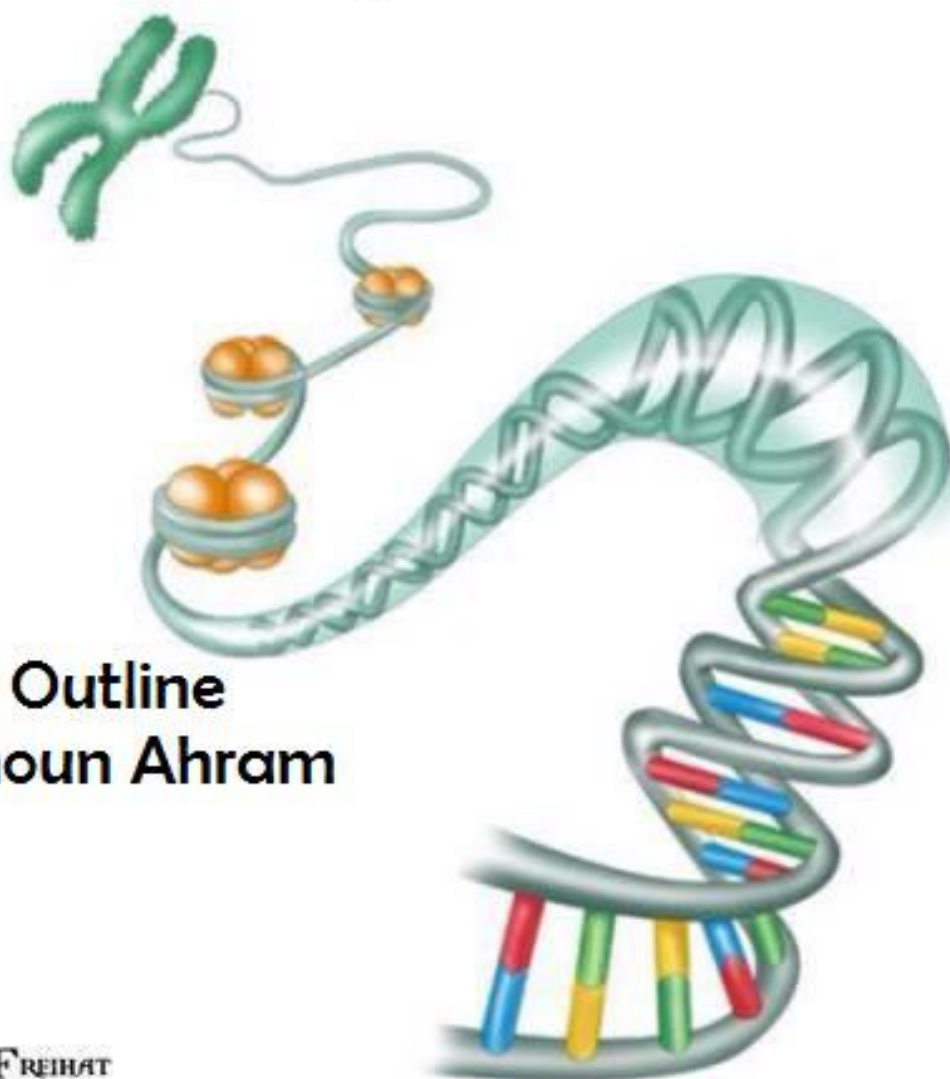


UNIVERSITY OF JORDAN
FACULTY OF MEDICINE
BATCH 2013-2019



GENETICS & MOLECULAR BIOLOGY

☐ Slides ☐ Sheet ☐ Handcut ☒ other.....**Syllabus**



Lecture #
Title: Course Outline
Dr. Dr. Mamoun Ahram
Done By:
Date:
Price:

DESIGNED BY NADEEN AL-FREIHAT

The University of Jordan
Faculty of Medicine
2014-2015

Course title: Principles of Genetics and Molecular Biology
Course code: 0501217
Credit hours: 3 credit hours
Calendar description: 16 weeks / Second semester / Year 2
Course coordinator: Prof. Mohammad El-Khateeb, Prof. Said Ismail, Dr. Mamoun Ahram

Course description: This is a three-credit hour course mandatory for second-year medical students. The course is designed to introduce medical students to the basics of cell and molecular biology and medical genetics. The basics include the study of cell structure and function, the genetic material, DNA and RNA, with regards to chemical structure, replication, transcription, translation, in addition to the study of basic molecular biology tools and techniques. The course also introduces students to the main principles of medical genetics in relation to various genetic disorders.

Learning Objectives

The overall objective is to: 1) study cell organization and function of the different components and abnormalities, 2) learn the basic processes of the central dogma of molecular biology including DNA replication, RNA transcription, and protein translation. 2) become familiar with basic molecular biology techniques involved in recombinant DNA technology, and 3) learn the genetic basis and the principles of disease inheritance.

Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding: Student is expected to

- A1- Recognize the different cell models.
- A2- Learn the molecular components of cells.
- A3- Understand the structure of plasma membranes of eukaryotic cells.
- A4- Know the different types of membrane proteins.
- A5- Recognize the role of membrane proteins in transport.
- A6- Understand the molecular mechanism of cystic fibrosis.
- A7- Understand the structure and role of the endoplasmic reticulum in protein synthesis and sorting.
- A8- Understand the role of the endoplasmic reticulum in lipid synthesis.
- A9- Understand the structure and roles of the Golgi apparatus in the synthesis of cellular molecules.
- A10- Understand the mechanism of vesicular transport.
- A11- Understand the structure and role of lysosomes and endosomes.
- A12- Understand the mechanism of endocytosis.
- A13- Recognize lysosomal storage diseases.
- A14- Understand the structure of the mitochondria.
- A15- Discuss mitochondrial diseases.
- A16- Understand the structure and function of peroxisomes and diseases associated with it.

- A17- Understand the structure of the nucleus and the nuclear membrane.
- A18- Know the nuclear lamina diseases.
- A19- Understand the structure and organization of the actin cytoskeleton.
- A20- Understand the role of actin and myosin in cell movement and muscle contraction.
- A21- Understand the structure and organization of microtubules and their role in vesicular transport.
- A22- Understand the structure and role of intermediate filaments.
- A23- Know the association of keratin dysfunction in skin diseases.
- A24- Recall the different components of the extracellular matrix.
- A25- Recall the steps involving the synthesis of collagen proteins.
- A26- Recall diseases related to collagen synthesis.
- A27- Understand the mechanisms of cell-matrix and cell-cell interaction.
- A28- Recall the different modes of cell signaling with emphasis on cell surface receptors and their intracellular signaling molecules and their cellular effects.
- A29- Understand the phases and molecular control of the cell cycle.
- A30- Understand the molecular regulation of cell death.
- A31- Understand the types and properties of cancer cells.
- A32- Recognize the basic features of DNA/RNA structures.
- A33- Learn the main steps and reactions involved in DNA replication.
- A34- Learn the main steps and reactions involved in RNA transcription.
- A35- Learn the main steps and reactions involved in protein translation.
- A36- Understand the various mechanisms and stages involved in regulation of gene expression.
- A37- Differentiate between the main types of DNA damage and the different mechanisms involved in DNA repair.
- A38- Understand the function and regulation of cancer related genes including oncogenes, tumor suppressors, and regulators of apoptosis.
- A39- Learn the basic molecular biology techniques involved in recombinant DNA technology.
- A40- Learn the concept of stem cells and their uses in therapy.
- A41- Recognize the genetic variations between individual s.
- A42- Recognize the main features of chromosome structure.
- A43- Differentiate between the main patterns of inheritance.
- A44- Understanding of nontraditional inheritance
- A45- Understand the basic principles of multifactorial inheritance.
- A46- Understanding the genetic basis of tumors
- A47- Recognize the main types of chromosomal aberrations.
- A48- Understand the basic principles of chromosomal disorders.
- A49- Focus on biochemical genetics and disorders of metabolism.
- A50- Understand the prevention and treatment of genetic disorders
- A51- Know the basics of pharmacogenetics and Pharmacogenomics.

B. Intellectual Analytical and Cognitive Skills: Student is expected to

- B1-Recognize the cellular organelles, their functions, structures, molecular components.
- B2-Understand the bases of diseases at the molecular and cellular levels.
- B3-Recognize the regulation of cell behavior and abnormalities associated with it.

- B4-Recognize the nature of the chemical bonds that compose the DNA and RNA molecules.
- B5-Understand how genetic information flow from DNA into RNA and then into functional proteins.
- B6-Get familiar with basic tools and techniques involved in genetic engineering.
- B7-Interpret data of recombinant DNA technologies.
- B8-Understand the molecular basis of oncogenesis.
- B9-Differentiate between the different mutations and genetic aberrations and their effect on human disease.
- B10- Know how to perform gene mutation/disease association studies.

Teaching/Learning Methods

Teaching Method	ILO/s
Lectures and Discussions:	90%
Homework and Assignments:	10%
Projects:	0%
Presentation	0%

Main References:

1. The Cell: A Molecular Approach, Geoffrey M. Cooper and Robert E. Hausmann, 6th edition, Sinauer Associates, 2013.
2. Mark's Basic Medical Biochemistry, Smith, Marks and Lieberman, Lippincott, Williams and Wilkins, 2009.
3. Emrey's Elements of Medical Genetics, Muller & Young, Churchill Livingstone, 13th edition, 2011.

Additional resources

1. The Cell: A Molecular Approach, Geoffrey M. Cooper, 2nd edition, Sinauer Associates, 2000.
<http://www.ncbi.nlm.nih.gov/books/NBK9839/>
2. The Medical Biochemistry page, <http://www.themedicalbiochemistrypage.org/>

Course Contents

Topic	No. of lectures	Week	Reference	ILOs
Introduction into cellular molecules, model systems of cell biology, and eukaryotic cell organelles	1	1	Cooper, Ch.1 (pp. 17-38) and Ch.2 (43-57)	A1-2
Biomembranes and membrane proteins and their role in plasma membrane transport	1	1	Cooper, Ch. 2 (pp. 58-64) Ch. 13 (515-543)	A3-6
Protein sorting and transport, and endoplasmic reticulum	1	1	Cooper, Ch. 10 (373-398)	A7-8
The Golgi apparatus and vesicular transport	1	2	Cooper, Ch. 10 (398-412)	A9-10
Lysosome, endocytosis, endocytosis, and lysosomal storage diseases	1	2	Cooper, Ch. 10 (412-416) Ch. 13 (544-553)	A11-13
Mitochondria and peroxisomes	1	2	Cooper, Ch. 10 (421-431, 450-455)	A14-16
The nucleus	1	3	Cooper, Ch. 9 (345-365)	A17-18
The actin cytoskeleton and cell movement	1	3	Cooper, Ch. 12 (459-482)	A19-20
Microtubules and intermediate filaments	1	3	Cooper, Ch. 12 (482-510)	A21-23
The extracellular matrix	1	4	Cooper, Ch. 14 (564-582)	A24-27
Cell signaling	1	4	Cooper, Ch. 15 (589-634)	A28
The cell cycle	1	4	Cooper, Ch. 16 (641-675)	A29
Cell proliferation, differentiation, and death	1	5	Cooper, Ch. 17 (681-692)	A30
Cancer: a cellular perspective	1	5	Cooper, Ch. 18 (713-723)	A31
Nucleic acid structure	1	5	Marks, Ch. 12	A32
DNA replication	1	6	Marks, Ch. 13	A33
RNA transcription	1	6	Marks, Ch. 14	A34
Protein synthesis	1	6	Marks, Ch. 15	A35
Regulation of gene expression	3	7	Marks, Ch. 16	A36
DNA repair	1	9	Marks, Ch. 13	A37
Cancer: a Molecular perspective	3	9-10	Marks, Ch. 18	A38
Recombinant DNA technology	3	10-11	Marks, Ch. 17	A39
Cell renewal and stem cells	1	11	Extracurricular material	A40

Topic	No of Lectures	Week	Reference	ILOs
Genetic Variation, polymorphisms and mutations	1		Medical genetics Ch 3	A40
Chromosomal basis of Hereditary	3		Emrey's, Ch 3 and 18	A 41 A 47
Patterns of Mendelian inheritance	3		Emrey's, Ch 7 and 19	A 43 A44
Biochemical genetics	1		Emrey's, Ch 11	A49
Multifactorial Inheritance and Population Genetics	1		Emrey's, Ch 9	A 45
Genetics and Cancer	1		Emrey's, Ch 14	A 46
Prevention and Treatment of Genetic Disease	3		Emrey's, Ch 20, 21, 23	A 50
Pharmacogenetics and Pharmacogenomics	1		Emrey's, Ch. 12	A 51