King Saud University

College Of Science

Department of Biochemistry

Syllabus for BCH 361 – Molecular Biology

Course Description

Molecular Biology is the study of the functioning of genes at the molecular level, from DNA to RNA and proteins. Molecular Biology arose from the traditions of biochemistry, microbiology and genetics. It is a large and ever-changing discipline. Molecular biology attempts to explain the heredity and functioning of cells in terms of the molecules that control them.

Molecular Biology is a foundational course to the study of molecular biology focusing on the structural and functional properties and relationships of DNA, RNA and proteins, followed by details of the "central dogma". This course is designed to give a good background in current Molecular Biology which should explain the processes required to pass genetic information from DNA to RNA to protein as well as the molecular mechanisms of DNA replication, repair, transcription, protein synthesis.

As the field of molecular biology is evolving rapidly, this course also examines how these processes are related to the human diseases in addition to basic biotechnology techniques and genetic engineering concepts.

Course Objectives

This course aims to

1- Explainhow different experiments led to the discovery that DNA is the hereditary material and flow of information from DNA to Protein.
2- Describe the structure and chemical properties of DNA and its organization into chromosome.
3- Explain the concept of central dogma and give an overview of the biological significance of DNA and RNA.
4- Explain how biomolecules (DNA, RNA, protein) function and interact to support life.
5- Molecular mechanisms of DNA replication and damage repair.
6- Compare and contrast the mechanism of prokaryotic and eukaryotic DNA replication, transcription and translation.

7- Describe the process of protein synthesisand howRNA splicing and mutations generates protein diversity.

Learning Outcomes and Expectations

I have developed the course to address several learning outcomes. After successful completing this course, students should be able to

1. Understand and be able to draw the structures of DNA and RNA.
2. Demonstrate detailed understanding of the molecular basis of information flow from DNA to proteins.
3. Know the steps involved in DNA replication and the enzymes involved in this process.
4. Learn the basic outline of gene expression (transcription and translation).
5. Become knowledgeable about the molecular biology concepts and terminology in the course.
6. Become comfortable with reading and critiquing primary research papers.

Reference textbook

Principles of Genetics by P. Snustad and M.J. Simmons, 6th Edition, 2012, John Wiley and Sons

Genetics: A Conceptual Approach, by Benjamin A. Pierce, 5th Edition,2015, W.H. Freeman

iGenetics: A Molecular Approach, by Peter J. Russell , 3rd Edition, 2012, Pearson

Content

1: Introduction to Molecular Biology	Definition of molecular biology and its relations with other disciplines, biology of life, Life diversity, Evolutionary history, Phenotype and genotype,
2: History of DNA	Discoveries that DNA is the hereditary material
3(1): DNA structure and function	Nucleotides and nucleosides, DNA structure, double helix formation through base-pairing (Watson-Crick),
3(2): DNA structure and function	double helix features, DNA forms, RNA structure, Difference between DNA and RNA, Chromosome , DNA coiling and packaging, Nucleosome,
3(3): DNA structure and function 4: Nucleotide metabolism	Physical and chemical properties, De novo purines and pyrimidines synthesis, nucleotide degradation , disease associated with nucleotide metabolism, nucleotide metabolism and cancer
5: Cell cycle and DNA replication 6: DNA damage and repair	Cell cycle, Central dogma, Gene expression, DNA replication, DNA polymerase, Fidelity and proofreading, Causes of DNA Damage Mechanisms of DNA Repair
7: Gene expression : transcription	Central dogma, Gene expression, gene structure, Promoter , RNA processing, RNA splicing, mRNA, alternative splicing,
8: Gene expression : translation	Central dogma, Protein, peptide, Genetic code, Protein synthesis, inhibition,

9: DNA mutation	DNA change, Mutation, Polymorphism, Mutagenesis, Genetic variation, Evolution and mutation,
10: Transposons	Repetitive DNA, Transposable elements,