BIOL-UA 21 Molecular and Cell Biology I

Instructors:
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Course Description:
In-depth study of cell biology, with an emphasis on the molecular aspects of cell function. Topics include protein structure and synthesis, gene expression and its regulation, cell replication, and specialized cell structure and function. The course provides an introduction to genomics and bioinformatics and examines developmental biology, evolution, and systems biology. Welcome to Molecular and Cell Biology! Our objective is to give you a firm and rigorous foundation in the principles of modern molecular and cellular biology. These concepts form almost all the basis for the great advances now being made in biology and the medical sciences. During this semester, we will discuss biomolecular structure and function, fundamental molecular biology of the cell, and recombinant DNA technology and genetic analysis. Genomics and bioinformatics will also be introduced and play an important role in recitation and group-learning activities.

Pre-requisites:
Principles of Biology II (BIOL-UA 12)
General Chemistry and Lab II (CHEM-UA 126)

Textbook and Required Materials:

Grading:
Midterm exam 1  25%
Midterm exam 2  25%
Final exam  30%
Recitation participation  5%
Recitation portfolio  10%
Recitation presentation  5%

Topics:
Introduction: Biomolecules and Cells
The Central Dogma I: DNA as chemical and genetic material
The Central Dogma II: RNA synthesis and properties
The Central Dogma III: protein synthesis and properties
Biomolecule structure and function
DNA replication and recombination
Recombinant DNA I: restriction enzymes, cloning and libraries
Recombinant DNA II: functional complementation, sequencing DNA and polymerase chain reaction
Recombinant DNA III: molecular analysis using cloned sequences
Chromosomes I: The microanatomy of eukaryotic DNA
Chromosomes II: DNA packaging in cells
Chromosomes III: DNA repair
Prokaryotic transcription
Eukaryotic transcription
Molecular genetic analysis I: gene discovery in model organisms
Molecular genetic analysis II: cloning a human gene
Molecular genetic analysis III: reverse genetics
Regulation of transcription I: DNA elements that control transcription
Regulation of transcription II: transcription factors
Epigenetics and nuclear organization
Genome editing
Post-transcriptional control
Translational and post-translational control
Sequencing and annotating an entire genome
Gene expression on the genome scale
Proteomics, metabolomics, microbiomics and systems biology
Comparative, functional, and personal genomics
Conclusion: The future of molecular biology