

Global Learning Semesters

Course Syllabus

Course: BIOL-390 Molecular Cell Biology

Department: Health and Life Sciences

Host Institution: University of Nicosia, Nicosia, Cyprus



Course Summary		
Course Code	Course Title	Recommended Credit Hours
BIOL-390	Molecular Cell Biology	4
Semester Offered	Contact Hours	Prerequisites
Please contact us	42-45	BIOL-230
Department	Level of Course	Language of Instruction
Health and Life Sciences	Upper Division	English

Course Description

The student will gain an in depth understanding of the molecular processes involved in gene function and regulation. Topics include a detail study of cell activities like replication, transcription and translation with emphasis on protein-nucleic acid interactions, molecular mechanisms of mutation and repair and the regulation of gene transcription in bacteria and eukaryotes. The student will also gain an understanding of the application of biochemistry in the study of Cell biology at the DNA/RNA level. The course format is 3 h of lectures per week and one 3h laboratory session per week.

Prerequisites

BIOL-230

Topic Areas

1. A Brief History; The Molecular Nature of Genes An Introduction to Gene Function
2. Molecular Cloning Methods and Tools for Studying Genes and Gene Activity
3. The Transcription Apparatus of Prokaryotes; Operons: Fine Control of Prokaryotic Transcription
4. Major Shifts in Prokaryotic Transcription; DNA-Protein Interactions in Prokaryotes
5. Eukaryotic RNA Polymerases and their Promoters
6. General Transcription Factors in Eukaryotes; Transcription Activators
7. Chromatin Structure and Its Effects on Transcription
8. Posttranscriptional Events I: Splicing; Capping, Polyadenylation and Other Events
9. Translation I: Initiation, Elongation and Termination
10. Ribosomes and Transfer RNA
11. DNA Replication I: Basic Mechanism
12. DNA Replication II: Detailed Mechanism and control
13. Homologous Recombination; Site-Specific Recombination and Transposition
14. Transgenic animals and cloning

Laboratory Exercise

This one-semester, project-based laboratory exercises give students the opportunity to characterize the enzyme

alpha-amylase. As students proceed through the sequenced experiments, they will learn the principles of DNA, RNA, and protein structure by using modern-day molecular biology laboratory techniques

1. Enzyme Amylase assay: Starch Plate Assay;
2. Quantitative Enzyme Assay ; Factors Affecting Enzyme Function
3. Analysis of Protein Structure Using RasMol; Analysis of alpha-Amylase Proteins by SDS-PAGE and Western Blotting
4. Analysis of DNA Structure Using RasMol;
5. Isolation of Chromosomal DNA from *Bacillus licheniformis*
6. PCR Amplification and Labeling of Probe DNA
7. Southern Hybridization
8. Restriction Enzyme Cleavage of Chromosomal DNA; Denaturation and Transfer of DNA to a Membrane; Southern Hybridization and Detection
9. Cloning the alpha-Amylase Gene; Cleavage of Chromosomal DNA; Cleavage of Plasmid DNA; Ligation of Chromosomal and Plasmid DNA; Transformation; Identification of alpha-Amylase Clones
10. Verification and Mapping of alpha-Amylase Clones; Verification of alpha-Amylase Clones Using PCR
11. Isolation of Plasmid DNA from alpha-Amylase Clones
12. Restriction Cleavage and Mapping of alpha-Amylase Plasmid DNA
13. Preservation of Recombinant Strains
14. Southern Analysis of alpha-Amylase Plasmid DNA
15. Enzyme Activity of alpha-Amylase Clones

Readings and Resources

Required Textbooks

1. Molecular Biology, Second Edition by Robert F. Weaver, Publishers: McGraw-Hill, 2001, ISBN: 0-07-234517-9
2. Molecular Biology of the Cell, Fourth Edition by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter Publisher: Garland Science; 4th Bk&Cdr edition (March, 2002) ISBN: 0815332181
3. BIOTECHNOLOGY:DNA to Protein--A Laboratory Project in Molecular Biology by Teresa Thiel, Shirley T. Bissen, Eilene M. Lyons, Publishers: McGraw-Hill, 2001 ISBN: 0-07-241664-5

Recommended Reading

1. Human Molecular Genetics" by T. Strachan & A.P. Read, 2nd edn. (1999), John Willy & Sons Inc. New York
2. DNA: The Secret of Life by James D. Watson, Andrew Berry (Contributor) Publisher: Knopf; (April 1, 2003) ISBN: 0375415467
3. The Double Helix : A Personal Account of the Discovery of the Structure of DNA by J. Watson (Author) Publisher: Touchstone Books; (June 2001) ISBN: 074321630X
4. G Protein Signaling: Methods and Protocols (Methods in Molecular Biology, V. 238) by Alan V. Smrcka Publisher: Humana Press (November 1, 2003) ISBN: 1588291375
5. Human Molecular Biology : An Introduction to the Molecular Basis of Health and Disease by Richard J. Epstein Publisher: Cambridge University Press; 1st edition (October 24, 2002) ISBN: 052164481X
6. Animal Transgenesis and Cloning by Louis-Marie Houdebine Publisher: John Wiley & Sons (April 11, 2003) ISBN: 0470848286
7. Molecular Biology of the Gene, Fifth Edition by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick Publisher: Benjamin Cummings; 5 edition (December 3, 2003) ISBN: 080534635X

8. Molecular Cell Biology, Fifth Edition by Matthew P. Scott, Paul Matsudaira, Harvey Lodish, James Darnell, Lawrence Zipursky, Chris A. Kaiser, Arnold Berk, Monty Krieger Publisher: W. H. Freeman; 5th edition (August 1, 2003) ISBN: 0716743663
9. Genes VIII by Benjamin Lewin Publisher: Prentice Hall; 1st edition (December 15, 2003) ISBN: 0131439812
10. Molecular Biotechnology: Therapeutic Applications and Strategies by Sunil Maulik, Salil D. Patel Publisher: Wiley-Liss; 1st edition (January 15, 1997) ISBN: 0471116815