



The Goodman
Faculty of Life Sciences
Bar-Ilan University

Last updated: March 21, 2022

Molecular Biology and Genetic Engineering A

80-242-01, 80-242-10

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Academic year: 2021-2022 **Semester:** 2nd **Hours/credits:** 2 hours lecture + 2 hours exercise / 2 credits

Mandatory

Prerequisites: None

Year in program & how often given, if relevant: 2nd year undergraduate course given once a year

Course Overview – Short abstract: Review of techniques and basic methodologies that are used by molecular biologists.

Learning outcomes – short descriptions: The course aims to provide students with a basic understanding of fundamental molecular biology techniques and their applications.

Assessment: Coursework and Grade structure: 75% - final exam, 25% - exercises and final exercise assignment. Students must get 60 or more in the final exam in order to pass the course.

Week-by-Week content, assignments and reading

Lesson #	Subject	
1	Introduction to molecular biology and genetic engineering, reminder of the central dogma of molecular biology,	

	DNA - restriction enzymes, separation of DNA molecules using gel electrophoresis	
2	cloning, plasmids, expression vectors	
3	hybridization of nucleic acids - DNA & RNA in situ hybridization, spectral karyotyping, Southern blot, Northern blot, probe labeling, RFLP, genomic library, cDNA library	
4	DNA sequencing - dideoxy sequencing, pyrosequencing, ion torrent-semiconductor sequencing, Illumina sequencing, SMRT sequencing, nanopore sequencing	
5	PCR	
6	RNA - Reverse transcription-PCR, Real-Time PCR, DNA microarray, RNA-seq and comparison of methods for the analysis of gene expression	
7	Proteins - separation of proteins using one dimensional SDS-PAGE, 2D gel electrophoresis, mass spectrometry analysis.	
8	antibodies, antibody generation, immunostaining, western blot	
9	immunoprecipitation (IP), co-IP, epitope tagging, fluorescent tagging and applications of fluorescent proteins, FRET	
10	characterization of protein-protein interactions (GST-pull down, Yeast Two-Hybrid), Protein microarray	
11	working with cells - cell separation, growing cells in culture, FACS, laser microdissection, bacterial transformation, introduction of nucleic acids into mammalian cells, transient and stable gene expression	
12	reporter genes, site-directed mutagenesis, analysis of protein-DNA interactions (DNA affinity chromatography, EMSA, ChIP, DNA footprinting)	
13	transgenic mice, gene inactivation: dominant negative, RNAi, generation of knock-out mice, knock in	

Bibliography:

Chapter 8, Molecular Biology of the Cell (6th Edition) by Alberts, Johnson, Lewis, Morgan, Raff, Roberts and Walter. Garland Science