



Al al-Bayt University
Department of Biological Sciences- AL-Mafraq-Jordan
Molecular Biology Syllabus: Bio 0404451– (3 Credit Hours)
Course Outline: 2020/2020-Autumn Semester

General Information:

<u>Instructor:</u>	<u>Prof. Fawzi Irshaid</u>	Telephone:	2120
<u>E-mail:</u>	<u>irshaid@aabu.edu.jo</u>	Office:	Abin-Rashed
<u>Classroom and Time:</u>	Online; Sun, Tue, Thu: 8:00-9:00	Office Hours:	Sun, Mon, Tue, Thu (9:00- 10:00)

Course Description:

This course is designed to study gene structures and functions. During this course, students will study the identification of DNA as genetic molecule. Students will study the tools that are commonly used for identification and characterization of both DNA and RNA. Also, This course is also designed to study the central dogma of molecular biology by which the information in genes flows into proteins (DNA → RNA → protein). These include DNA replication, transcription and translation in prokaryotic and eukaryotic cells. Students will study the steps of DNA replication, transcription and translation (Initiation, elongation and termination), the factors and enzymes involved in these three processes, their structures and functions. We will also study the post transcription events (mechanism of capping and polyadenylation, splicing and editing) in prokaryotes and eukaryotic and posttranslational modification. Students will learning how cells regulate gene expression in both eukaryotic and prokaryotic organisms. We will focus in studying the mechanisms of lac operon and the trp operon in prokaryotic cells. Critical experiments will be examined to learn how our current understandings have come about. Techniques in molecular biology will be examined in lecture as necessary to understand experiments and concepts.

Recommended Text:

1. Molecular Biology, 5rd ed. Weaver, R.F. (2012). Jones and Bartlett Publishers, Inc.
2. Molecular Biology, 2th Ed. David Freifelder. Jones and Bartlett Publishers, Inc.
3. Genetics: Analysis and Principles, 7th edition (2021). Author: Robert Brooker, Publisher: McGraw-Hill.
4. Genomes, 2nd Ed (2002) TA Brown, John Wiley and Sons Publishers, Inc.
5. The Molecular Biology of the Cell, Sixth edition (2014). by Bruce Alberts, D Bray, J Lewis, M Raff, K Roberts and James D. Watson. New York, Garland Publishing.
6. **Notes and handouts will be available in PowerPoint in the e-learning site of this course. These handouts are your main source of information. If you choose to print handouts, you can print several slides on one page using a variety of layouts, some with space for note-taking.**

Prerequisites: Cell biology 0404252 and Genetic 0404248

Examination and Grading:

1. There is one midterm exams and a final exam, which are in multiple choice, fill in the blank matching, identification of figures and short answer/essay format.

2. There is a 1/12 hr block of time reserved for each midterm exam. Time and place for each exam will be announced later.

4. The distribution of points will be as follows:

<u>Exam</u>	<u>Grading (%)</u>
1. First midterm exam:	20%
2. Second midterm exam:	20%
3. Homework and Quizzes:	10%
4. Final Exam:	50%
Total point:	100%

Home work:

There are a set of home works and they will be announced by the instructor. You will be graded on them, and won't even hand them back. These are essentially study guides and you are expected to do them after each chapter that we discussed. Ideally, you should plan on submitting a completed homework every two weeks. Some of these assignments require some library research and planning, so do not leave it till the last minute to work on home assignments.

The final exam (important note):

1. The final exam will be comprehensive.
2. I will not allow a final to be made up unless you have a hospital record.
3. The corrected exam forms will not be returned to the student.
4. For this reason, students should make a note of any questions they are unsure of while they are taking each exam. Difficult or confusing questions can be discussed with the instructor.

Attendance Policy:

1. I strongly recommend you attend every lecture. Missing any class will put you at a distinct disadvantage when test taking.
2. Any student with six or more unexcused absences from lecture sessions can be legally dropped from the course.
3. Students who miss an exam due to illness or other valid excuse must notify me within the first week after the exam, so make up arrangements can be made.
4. The only other valid excuses for missing an exam are: death in the family, illness, or accident. In such cases you must provide evidence of some kind and you must reschedule within 3 days.
5. Make ups for major exams will consist of detailed essay questions rather than multiple choice questions.

How to access E-learning system:

1. To use the E-learning system (Moodle) in University of Al al-Bayt, you need to get a user name and password from computer center at the University or call the staffs at the computer center.
2. Once you obtain your user name and password, you can login to the E-learning system.
3. Open the university of website: (<https://www.aabu.edu.jo/EN/Pages/default.aspx>) - From the portal or center choose E-learning.
4. After successful login, you will see a list of your courses. Access the course you want by click on its name.

5. After accessing your course, you will see a page contains the file for each lecture. Click any file to download it.
6. To access course assignments, click assignments link. After you click on the assignment link you will see all the assignments that have been posted by your instructor, note that each assignment has a full description including assignment type, due date and cutoff date.
7. When a student wants to participate in a Forum activity, he or she first clicks on the front page link to the forum. There is a button to begin a new conversation.
8. If you need any help you can contact the computer center staffs they will answer your question.
9. There are several files that can show you step by step how to access the e-learning system and download your files, assignments, and quizzes and much more.

Academic Misconduct:

1. Students are expected not talk in class while the instructor is lecturing, either during lecture or laboratory.
2. After two warnings for talking or any other classroom disruption, the student will be automatically removed from the class.
3. Any act of cheating, plagiarism, or academic misconduct is subject to the penalties. The minimum penalty for any student caught cheating on an exam will receive a zero on that test or will receive a letter grade of "35%" for the semester.

MOLECULAR BIOLOGY COURSE TOPICS:

1. Course Introduction: syllabus and other general information
2. Evidence of DNA as the primary genetic material: we'll look at some of the classic experiments that led to the identification of DNA as the carrier of genetic information. These include the Griffith Experiment with *Streptococcus pneumoniae*, and Avery, MacLoed and McCarty experiment and the blender experiment of The Hershey and Chase experiment.
3. DNA structure and function overview: Discovery of DNA, a basic description of the structure of DNA, including nucleotides, base pairing, and the double-helix nature of the molecule, the antiparallel structure of DNA strands, and DNA forms.
4. DNA and RNA analysis and characterization: DNA denaturation and renaturation, gel electrophoresis, and DNA and RNA purification and quantification.
5. DNA replication in prokaryotic: Stages of replication (initiation, elongation and termination), basic mechanism and enzymology. Semi-discontinuous replication, replication strategies, bacterial DNA polymerases, priming, synthesis elongation of lagging and leading strands, DNA Pol III subunit functions, termination.
6. DNA replication in eukaryotic: Stages of replication (initiation, Elongation and termination), eukaryotic DNA polymerases and telomerase.
7. Gene structure and transcription in prokaryotic cells: *E. coli* RNA polymerase and stages of transcription (initiation, elongation and termination) and functions of *E. coli* σ subunits.
8. Gene structure and transcription in eukaryotic cells-1: Stages of transcription (initiation, elongation and termination), Types of RNA polymerases, promoters, upstream control elements (enhancers, silencers and insulators). RNA Pol II structure and subunit functions.
*** The midterm exam: place and time will be announced by the University**
9. Eukaryotic transcription-2: General transcription factors, basal transcription complex formation. Eukaryotic transcriptional activators: specific TF structural classes, chromatin structure & regulation, histone modifiers, coactivators & corepressors.

10. Post-transcriptional events: The mRNA-capping, mRNA polyadenylation, exons & introns, splicing, spliceosomes, snRNPs, self-splicing introns, trans-splicing, RNA interference, siRNAs, miRNAs, other ncRNAs and RNA editing.
 11. Prokaryotic translation overview: Stages of translation (initiation, elongation and termination) and ribosome structure & function, genetic code.
 12. Eukaryotic translation overview: Stages of translation (initiation, elongation and termination) and translation factors and their functions.
 13. Post-translational modification (protein processing): phosphorylation, glycosylation, ubiquitination, nitrosylation, methylation, acetylation, lipidation and proteolysis.
 14. DNA damage & repair: Point mutation, nonsense and frame shift mutations, unequal crossing over
 15. Control of gene expression in prokaryotes: Operon models and major shifts in bacterial transcription
 16. Control of gene expression in eukaryotes: Methylation, acetylation and phosphorylation.
 17. Recombination overview: recombination in phage, prokaryote & eukaryote
 18. Recombinant DNA biotechnology: gene cloning, PCR, RT-PCR, gel electrophoresis & DNA sequencing
- * **Final exam: Time and place will be announced by the University.**