



Department of Biology

College of Education

Salahaddin University-Erbil

Subject: Molecular Biology

Course Book – (Year: 4)

**Lecturer's name: Asst. Prof. Dr. Hêro Farhad
Salah**

Academic Year: 2022-2023

Course Book

1. Course name	Molecular Biology
2. Lecturer in charge	Asst. Prof. Dr. Hêro Farhad Salah
3. Department/ College	Department of Biology/ College of Education
4. Contact	e-mail: hero.salah@su.edu.krd
5. Time (in hours) per week	Theory : 2hr
6. Office hours	6 Hours per week The best way to reach me for questions, appointments etc. is by email!
7. Course code	EdB0405
8. Teacher's academic profile	<p>-Ph.D. in Molecular Microbiology and Molecular Biotechnology, University of Salahaddin-Erbil, Kurdistan Region/Iraq in collaboration with University of Malaya-Malaysia, 2013-2017.</p> <p>Thesis Title: Cloning of Staphylokinase (<i>sak</i>) Gene from <i>Staphylococcus aureus</i> into <i>E. coli</i> Strain BL21(DE3) and Assessment its Properties <i>in vitro</i> and <i>in vivo</i>.</p> <p>-M.Sc. in Microbiology, University of Salahaddin-Hawler, College of Education, Biology Dept., 2004-2007.</p> <p>Thesis Title: Effect of Some Medicinal Plant Extracts on Antibiotic Resistance by Plasmids of <i>Escherichia coli</i> Isolated from Different Sources.</p> <p>-Main Teaching Areas:</p> <p>Molecular Biotechnology, Molecular Biology, Microbiology, Pathogenic Bacteria, <i>Comparative Anatomy of Chordates</i>, <i>Zoology</i>.</p> <p>Trainings that participated:</p> <ol style="list-style-type: none"> 1. Real Time PCR (2019). Induction Course (2016). 2. Responsible Care and Use of laboratory Animal Course/ Rabbit (Techniques on Handling, Anesthesia, Euthanasia, Parenteral Administration and Blood Collection) - (2016). 3. Editing Your Manuscript for Publication (2016).

	<p>4. EndNote workshop: EndNote software Biology Dept.- College of Education/ Salahaddin University, 14-15 Nov. 2014.</p> <p>5. EndNote workshop: EndNote software Biology Dept.- College of Education/ Salahaddin University, 14-15Apr. 2013.</p> <p>6. Training of e-Learning, Salahaddin University, (2012).</p> <p>7. English Training Course, Salahaddin University, (2009).</p> <p>8. Computer Training Course (ICDL), Salahaddin University, (2009).</p> <p>9. Training of teaching methods, Salahaddin University, (2009).</p> <p>10. Computer Training Course, (2004).</p>
<p>9. Keywords</p>	<p>DNA, RNA, Gene, Replication, transcription, and translation</p>
<p>10. Course overview: This module is a major (Mandatory) Departmental course for the Fourth Year. Molecular Biology: is a branch of science concerning biological activity at the molecular level. The field of molecular biology overlaps with biology and chemistry and in particular, genetics and biochemistry. This science introduces student the structure and function of the molecules, including DNA and RNA, which allow genes to be expressed and be maintained from one generation to the next. Methods for genetic transfers: transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating. Replication: DNA as a genetic material, Replicons –enzymes involved in DNA replication: replication origin and replication fork, initiation, elongation and termination. Semiconservative and semi-continuous replication. Overview of Gene Expression: Transcription, RNA polymerase, promoters, initiation, elongation and termination; Major shifts in transcription. Translation: Structures of tRNA and ribosome, genetic code, mechanism of translation (initiation, elongation and termination). Fine control of bacterial transcription: lac, Trp and lambda operons as models. Student will also learn about genetic engineering, its application, and the ethical issues associated with its use.</p>	
<p>11. Course objective: At the end of this module, student will:</p> <ul style="list-style-type: none"> • Be able to review critically the fundamental and key concepts of Molecular Biology and gene cloning. • Learn about DNA, RNA and proteins and the molecular events that govern cell function while exploring the relevant aspects of biochemistry, genetics and cell biology. 	

- Be able to provide a general introduction to the molecular basis of genetics, how genes are maintained from one generation to the next and how their expression is regulated in various systems.
- Be able to grasp a common and valuable techniques used by molecular Biologists.
- Be able to understand a broad range of experimental techniques used in molecular biology and how they are used to improve the concepts of replication, transcription and translation.

12. Student's obligation

Attendance: This is mandatory as there will be no makeup quizzes. A weekly official class attendance record will be maintained and become part of each student's record.

Laboratory exercises: Students taking this course are also to take the laboratory class. The laboratory exercises account for 50% of the total marks awarded. Students will be required to wear protective clothing during laboratory exercises. Laboratory reports must be typed and submitted no later than seven (7) days after completion of the exercise. No laboratory make-ups will be done. No laboratory reports will be accepted from students who did not perform the exercise.

Assignments: There will be one assignment including a report about one topic in Molecular Biology field, may be before or after mid-term. No late submissions will be accepted without prior consultation and approval of the instructor. Oral presentation may be necessary.

Grading: The final grade of both semesters will be the average of grades earned on exams, assignments.

Studying: How should you study for this course? Go over your lecture notes after each lecture, while the material is still fresh on your mind. Although some memorization is invariably necessary when learning a new "language", the goal of learning is to understand the information, not to simply memorize a bunch of disconnected "facts". A major purpose of studying is to discover what you don't understand so that you can do something about it. Don't just passively read the notes, think about them and ask yourself questions about them. Do you understand what was said? Does it make sense and why? Compare and contrast the new information with things that you have already learned. Some people find study groups very helpful for the learning process. Keep up regularly. You can't cram all of the information into your brain the night before an exam, and we may not be available to answer your questions at the last minute. For this upper division lecture and laboratory course – you should plan to spend at least 4 hours per week OUTSIDE of class studying for this course.

13. Forms of teaching

To reach the objectives of the course, different forms of teaching will be used and which include the following: Presenting each lecture notes as a power point presentations (ppt.), sometimes writing the exciting notes on the whiteboard, and may be some related video (educational movies/youtube/animation) will be showed in addition, answering the questions asked by students in the lecture and student discussion groups are encouraged.

14. Assessment scheme

There will be a mid-term and final examination (there will be one announced test and one oral quiz per semester. No makeup exam will be given).

The grades including:

1. Attendance 1 grade
2. Comprehensive final examination equal to

<p>1st Semester 45%</p> <p>2nd Semester 45%</p> <p>Homework + Quizzes as assigned 10%</p> <p>3. Total: 100% Credit Points: 10% + 1 grade for attendance = 10%</p> <p>Final Credit Points: 50%</p>	
<p>15. Student learning outcome:</p> <p>The student will be familiar with main topics in biology which concerned with replication, transcription, translation and how these processes are regulated.</p> <ul style="list-style-type: none"> • Cognitive skills (thinking and analysis). The lecturer will present the material in the text book in an interactive way that stimulates the thinking side of students. Conducting the learning objectives for each module components in clear manner to insure the material is digested by the students. • Communication skills (personal and academic). -Module language: English -For every lecture the last five minutes will be open for discussion. For further discussion, the students are welcome at the lecturer's office hour as appeared in first page. -the students have the option to submit their module activities either by email or by hand -the students are welcome to share open discussions through the net • Practical and subject specific skills (Transferable Skills). -Practical related session will be taken in the Practical sessions of Molecular Biology (Lab). 	
<p>16. Course Reading List and References:</p> <p>Books:</p> <ul style="list-style-type: none"> • David P. Clark. <i>Molecular Biology</i>. Waltham, MA: Academic Press, ©2013. • Robert Weaver. <i>Molecular Biology</i>, 5th Edition. WCB/McGraw-Hill. ©2012. • Watson, J. D. et al. <i>Molecular Biology of Gene</i>. 7th edition. Pearson. 2017. <p>Websites:</p> <ul style="list-style-type: none"> - http://en.wikipedia.org/wiki/DNA_replication#DNA_structure - http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/P/Promoter.html#Transcription_start_site. - http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/T/Translation. <p>Journals:</p> <ul style="list-style-type: none"> • Biotechnology Publisher: the Asian Network for Scientific Information http://www.ansinet.org/c4p.php?j_id=biotech • Genetics & Molecular Biology Publisher: Brazilian Society for Genetics http://www.scielo.br/cgi-bin/fbpe/fbsite?got=site &pid=1415-4757&lng=en • American Journal of Biochemistry & Biotechnology Publisher: the Asian Network for Scientific Information http://ansinet.org/sciencepub/c4p.php?j_id=ajbb 	
17. The Topics:	Lecturer's name
Course programmed	Asst. Prof. Dr. Hêro/ Group I, Group II
Week 0:	

<p>General concept</p> <p>Week I: Definition of Molecular Biology, Genome, Origin of term, DNA as genetic material,</p> <p>Week II: DNA Structure and Topology</p> <ul style="list-style-type: none"> •Description the classical experiments involved in the determination of DNA as the genetic material. •Listing the components of nucleotide in DNA/RNA •Distinguish between deoxyribose and ribose. •Description how nucleotides are linked together to form DNA. •Explanation the characteristics of the DNA double helix •Description the packaging and organization of the secondary structures of DNA in prokaryotes and eukaryotes •Description the structure and function of DNA <p>Week IV: DNA Replication</p> <p>Nucleic acid, Chemical structure, Types of nucleic acid, RNA, DNA, Nucleoside, nucleotide and deoxy-nucleotide.</p> <p>Explain the experiments which lead to the conclusion that DNA replication occurs in a semi-conservative manner?•Describe the function of all the components such as proteins and enzymes that are necessary forthe initiation and synthesis of DNA?•Describe how DNA is synthesized?•Discuss the significance of the origin of replication (Ori)?•Indicate the functional properties of DNA polymerases?•Discuss how proofreading of DNA replication occurs?•Compare DNA replication in prokaryotes and eukaryotes?•Compare DNA synthesis on the leading and lagging strand of the DNA?•Describe how topoisomerases modify stress on the DNA double helix during DNA replication?•Describe how the length of a chromosome is maintained by telomerase following DNAreplication?</p> <p>Week V:</p> <p>Primary structure of DNA, DNA methylation, polynucleotide strand, RNA structure, types of RNA.</p> <p>Week VI:</p> <p>DNA replication, definition.</p> <p>Week VII:</p> <p>Mechanism of DNA replication, Difference between prokaryote and eukaryote in DNA replication.</p>	<p>2hr *2/ Monday</p>
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<p>Week VIII: Models of DNA replication, meselson and stahl experiment, evidence of most acceptable model.</p> <p>Week IX: Gene definition, structural gene, regulatory gene, promoter.</p> <p>Week X: Operator, repressor protein in gene regulation function.</p> <p>Week XI: Gene expression, Central dogma in molecular biology Transcription, Translation.</p> <p>Week XII: Steps of DNA transcription, Initiation, Elongation, and Termination.</p> <p>Week XIII: Difference between prokaryote and eukaryote, Posttranscriptional modification.</p> <p>Week XIV: Structure of tRNA, mRNA, rRNA, ribosome and site of mRNA. binding, ribosome in prokaryote and eukaryote.</p> <p>Week XV: Genetic code, General feature, The 64 codon, The reading frame, The almost universal genetic code.</p> <p>Week XVI: Protein synthesis, translation, Definition, Steps of translation.</p> <p>Week XVII: Initiation, elongation.</p> <p>Week XVIII: Termination, Energy needs for protein synthesis, Difference between prokaryote and eukaryote.</p> <p>Week XIX:</p>	
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<p>Control of gene expression, Control of metabolism, Operon.</p> <p>Week XX: Lactose operon, Component of lactose operon, Inactivation of lactose operon.</p> <p>Week XXI: Molecular cloning method, Gene cloning, The role of restriction endonuclease, vectors, Identifying specific clone.</p> <p>Week XXII: Molecular cloning method, Gene cloning.</p> <p>Week XIII: The role of restriction endonuclease, vectors, Identifying specific clone.</p>	
<p>18. Practical Topics (If there is any)</p>	
<p>An introduction: Protein, DNA, RNA, Extraction of bacterial genomic DNA, Agarose gel electrophoresis: DNA conformation and size, Isolation of plasmid from <i>E. coli</i>, PCR: Polymerase chain reaction, Real Time PCR, DNA sequencing, DNA cloning, DNA cloning(continue), DNA microarrays, DNA Blotting, Transformation: Preparation of Competent Cell, Transformation, DNA marker, DNA Forensics, DNA Curing, Restriction endonuclease digestion of DNA,</p>	<p>Asst. Prof. Dr. Seevan 6 groups, each group (2hrs /Sunday)</p>
<p>19. Examinations:</p> <ol style="list-style-type: none"> 1. Complete the following blanks. 2. True or false and correct the false one. 3. Multiple choices. 4. Match the two following columns. 5-Count the following. 6-Explain or discuss or mention the following or why? 7-Write about the following. 	

8- Draw and Label.

9- Write the differences between the following:

10- What means the following:

20. Extra notes:

21. Peer review