



Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Microbial Genetics

Course Book – (Year 4)

Lecturer's name: Mohamed Ali Saleem, M.Sc.

Academic Year: 2022/2023

Second Semester

Course Book

1. Course name	Microbial Genetics
2. Lecturer in charge	Lecturer Mohamed Ali Saleem
3. Department/College	Biology / Science
4. Contact	e-mail: mohammed.saleem@su.edu.krd Tel: 0750 413 21 45
5. Time (in hours) per week	Theory: 2 Practical: 2
6. Office hours	To be Return to the schedule on the office door
7. Course code	
8. Teacher's academic profile	<p>I graduated from Salahaddin University-Erbil in 2004, accepted in post graduate MSc. In 2007 I finished my MSc degree and start as Assistant Lecturer Teaching Practical Genetics, Practical Microbial Genetics, Practical Biology, Practical Zoology, and Practical Ecophysiology. In 2020, accepted in PhD degree in Molecular Genetics. From 2017 till now I am in charge in teaching Genetics theory for 4th class students. For 8 years (Between 2010-2016) and (2018-2020) I worked as a Member of the Examination Committee for College of Science.</p> <p>My experience:</p> <ul style="list-style-type: none">• Assist. Lecturer in College of Science 2010.• Lecturer in College of Science 2014.• Rapporteur of Biology Department/ College of Science from September 2010 till 2016 and 2018 till 2020.• Member of editorial board of Zanco Journal of Pure and Applied Sciences/ Salahaddin University- Erbil from 2019-2020.• Member of National Ranking Committee of Salahaddin University- Erbil from 2019-2021• Head of Biology Department February 2022 till now.
9. Keywords	Microbial Genetics, Genetic transfer in Bacteria, Regulation of gene expression in bacteria, Repair system, Genetic recombination in bacteria.
10. Course overview:	<p><u>Course description, objectives, and format</u></p> <p>Genetics is one of the basic science courses that comprise the Biology curriculum of the four years of Science College. The overall goal of these courses is to provide with the knowledge and understanding of the scientific principles that are the basis of current approaches to know the genetic basis of organisms. The application of these scientific principles and knowledge to the practice of science and diseases, including the development of life-long learning and problem-solving skills, is emphasized. The genetic course consists of 30 lectures (annually) and covers topics are integrated with the concurrent agriculture, medicine, statistics, microbiology, pathology, and integrated problems.</p> <p>Lectures from basic sciences, clinical disciplines and microbiology teach the fundamental principles of genetic and how these principles apply to the diagnosis and treatment of these problems in above fields.</p> <p><u>Course learning objectives</u></p> <p>By the end of this course, students will be able to apply their basis background in genetics to the practice of agriculture, scientific research, including the effective diagnosis, treatment and</p>

prevention of genetic disease. Detailed learning objectives are provided for each lecture.

11. Course objective:

Each lecture is accompanied by a power point presentation. Information from the presentation and assigned reading is important for mastering the learning objectives which are the primary focus of exam questions.

12. Assessment scheme

Examinations

There will be at least one obligate exam through the semester (10 marks), the exam will contain, short answer questions, long answer questions, make the diagram, etc. .

Quizzes and weekly assignments:

There will be at least 3 quizzes through the semester (5 marks), the practical exam has (35) marks, so the final grade will be based upon the following criteria:

Sum of exam and quizzes: 15%

Practical examination: 35%

Final examination: 50%

13. Student learning outcome:

At the end of your undergraduate teaching, you will be expected to be able to:

- Recognize the genetic and environmental contribution to multifactorial conditions.
- Be familiar with the microbial generics.
- To know the genetic recombination in bacteria.
- Be familiar with the repair systems.
- To know the genetic transfer in bacteria.
- Types of mutations, mutagens.
- To know some approaches of biotechnology and their applications.

14. Course Reading List and References:

1- Nester, M.T. (2001). Microbiology a human perspective (3rd ed.). Mc Graw Hill, U.S.A

2- Tortora, G.J.; Funke, B. R. and Case, Christine, L. (2004). Microbiology: an introduction (6th edi.). Pearson, Benjamin Cummings. U.S.A

3- Brooker, Robert J. (2005). Genetics (analysis and principles). Mc Graw Hill. U.S.A.

4-Pierce B.A. (2006). Genetics, A conceptual approach (2nd edi.). W.H. Freeman and Company. New York, U.S.A

15. The Topics:

Topics	Lectures
Introduction	Course outline, how to study Genetics, the role of genetics in life, distribution of marks, exams, and final exams
Microbial genetics, Types of mutation	Definition, What Are Mutations?, causes and types, Are mutations helpful or harmful?, single base-pair mutations, point mutation, substitutions, inversion, additions, Deletions, tautomeric shifts
Mutagenic agents and the mechanisms of mutation	Physical agents, ionizing and non-ionizing radiation, chemical agents, nitrous acid, hydroxylamine, base analogue mutagen, alkylating agents, acridines
Detection and isolation	(a) Plating the bacteria on antibiotic media, Visible Mutations, Auxotrophic Mutations, Conditional Mutations, Resistance Mutations, Using minimal media

of mutants	with sugars. (b) Using minimal media with sugars. Replica plating technique, Ames test
Repair of DNA	Photoreactivation repair, Base excision Repair, Nucleotide Excision Repair, Recombination repair, MisMatch Repair, SOS response, Double strand break repair
Regulation of gene expression, inducible operon	Definition, the operon system, genetic map of lactose operon, negative and positive control, Catabolite repression
Repressible operon	Definition, genetic map of tryptophan operon, Organization of the trp operon and regulation via the trp repressor protein, attenuation, Comparative properties of inducible and repressible operons
Genetic transfer & recombination in bacteria	Genetic recombination, homologous recombination, transformation, transduction, conjugation, conjugation in gram-positive bacteria
Introduction to cloning and recombinant DNA technology	DNA cloning, DNA sequencing, detection of disease genes, Polymerase chain reaction (PCR)
Application of recombinant DNA technology and gene therapy	(PCR basics, PCR in medicine, PCR in forensics), agricultural applications, transgenic mammals,
Continue to lecture	Medical applications, recombinant DNA vaccines, methods of gene therapy
Genetics of cancer	Cancer is a genetic disease, cell cycle regulation and cancer, predisposition to cancer, causes of cancer, cancer and environment

16. Examinations:

Q1) Draw the schematic diagram by which **2-amino purine** induced mutation.

Q2) Explain with figure the attenuation mechanism of controlling **trp operon**.

Q3) Explain with figure the tautomeric shift of **Guanine** and **Cytosine**.

Q4) Explain with figure the **Base excision Repair** system.



Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Practical Microbial Genetics

Course Book – (Year 4)

Lecturer's name: Govand Musa Qadir, M.Sc.

Academic Year: 2022/2023, 2nd Semester

Course Book

1. Course name	Practical Microbial Genetics
2. Lecturer in charge	Govand Musa Qadir
3. Department/ College	Biology/ Science
4. Contact	e-mail: govand.gadir@su.edu.krd Tel: (optional)
5. Time (in hours) per week	2 hrs./week
6. Office hours	3 hrs./week
7. Course code	
8. Teacher's academic profile	
9. Keywords	Bacterial Chromosome, Genes regulation in Bacteria, Operon, Bacterial Mutation, Isolation of Mutant bacteria, Conjugation, Transformation, and Ames test.
10. Course overview: <ul style="list-style-type: none"> • The importance of studying the Bacterial Genetics. • Understanding of how bacteria regulate its Genes expression. • Understanding of the principles bacterial conjugation and transformation. • Induction of Mutation in Bacteria and Isolation of Mutant Bacteria. • What are the differences between Gene Induction and Repression mechanisms? • What are the components of bacterial Operon? • Understanding of the mutagens and mutation. • Understanding of how resistant gene could transfer among bacteria. • What are plasmids and its importance for bacteria? • Testing the gene regulation of bacteria in the lab. • Testing Bacterial transformation and conjugation in the lab. • Testing induction of mutation and isolation of mutant in the lab. • Understanding of mutagenicity and carcinogenicity of chemicals by using Ames test (Bacterial model). 	
11. Course objectives: <ul style="list-style-type: none"> ▪ Introduction to Bacterial Genetics and Safety rules of the lab. ▪ Providing information about study microbial genetics. ▪ Understanding the concepts of induction. ▪ Understanding the mechanism of repression. ▪ Counting the number of antibiotic-resistant mutant (spontaneous mutation) bacteria ▪ Differentiate between direct and indirect mutant selection. ▪ Auxotrophic mutant production and differentiate between it and prototrophs. ▪ Isolation of mutant bacteria by replica plating. ▪ Detection of possible mutagens and carcinogens by Ames test. ▪ Understanding the mechanism of bacterial conjugation ▪ Understanding the process of transformation. 	
12. Student's obligation *Exam policy: Student Should take at least 1 exam during the course. *lab polices:	

- 1- **Attendance:** You are strongly encouraged to attend class on a regular basis, as participation is important to your understanding of the material. You are responsible for obtaining any information you miss due to absence.
- 2- **Lateness:** Lateness to class is disruptive.
- 3- **Electronic devices:** All cell phones are to be turned off at the beginning of class and put away during the entire class.
- 4- **Talking:** During class please refrain from side conversations. These can be disruptive to your fellow students and your professor
- 5- **No Disrespectful to both the teacher and to your colleagues.**
- 6- **Weekly Quizzes:** every lab you should take quiz
- 7- **Lab coat:** you have to wear your lab coat to your protection.
- 8- **Eating and drinking is prohibited inside the lab.**
- 9- **You should monitor and records your practical works and results.**

13. Forms of teaching

- Course book
- Data show and power point.
- Scientific videos.
- Seminars.
- Papers for practical work and notes.
- Whiteboard.

14. Assessment scheme:

Exam 1	60% marks
Quizzes and Weekly lab activates	40% marks

15. Student learning outcome:

- The importance of studying the Bacterial Genetics.
- Understanding of how bacteria regulate its Genes expression.
- Understanding the principles of bacterial conjugation and transformation.
- Induction of Mutation in Bacteria and Isolation of Mutant Bacteria.
- What are the differences between Gene Induction and Repression mechanisms?
- Understanding of how resistant gene could transfer among bacteria.
- How to test the gene regulation of bacteria in the lab.
- How to test Bacterial transformation and conjugation in the lab.
- How to Perform Ames test in the lab.

16. Course Reading List and References:

- 1) Johnson, T.R and Case, C.L.(2007). **Laboratory experiments in microbiology.**
- 2) Alexander, S. K., Strete, D. and Niles, M.J. (2004). **Laboratory exercises in organismal and molecular microbiology.**
- 3) Harley, J. P., and Prescott, L. M. (1996). **Laboratory exercises in microbiology. Third edition.**
- 4) Brown, A. E. (2005). **Bensons microbiological applications.**
- 5) Atlas, R. M., Park, L. C. and Brown, A. E. (1995). **Laboratory manual of experimental microbiology.**

17. Practical Topics	
<ol style="list-style-type: none">1. General lab safety rules and course book2. Gene regulation: Induction.3. Gene regulation: Repression.4. Gene regulation: Catabolite Repression.5. Selection of Bacterial Mutants Resistant to Antibiotics.6. Isolation of Auxotrophic Mutants and Replica Plating Technique.7. Ames Test for Detecting Possible Chemical Carcinogens.8. Bacterial Conjugation: The Transfer of Antibiotic-resistant Plasmids.9. Transformation: A Form of Genetic Recombination.10. Second Exam	
18. Examinations: 1. Compositional: In this type of exam the questions usually starts with Explain how, What are the reasons for...?, Why...?, How....? Example: write the mechanism of induction. 2. test identifying: Example: identify this test (in the picture or direct) 3. fill the blanks: Example: <u>The operator gene</u> is binding site of repressor protein.	
19. Peer review Peer name: Dr. Mustafa S. Mustafa Al-Attar.	