

Ministry of Higher Education and Scientific research



Department of *Medical Laboratory Technology*

College of Erbil Health Technical

University of Erbil Polytechnic

Subject: *Genetics & Molecular Biology*

Course Book – (3rd stage)

Lecturer's name: *Dr. Zjwan Mohammed Ismail, PhD*

Academic Year: 2022/2023

1. Course name	Genetics & Molecular Biology
2. Lecturer in charge	Zjwan Mohammed Ismail
3. Department/ College	Ministry of Higher Education and Scientific research
4. Contact	e-mail: zjwan.h@epu.edu.krd
5. Time (in hours) per week	Theory: 2 Practical: 12 (4 groups)
6. Office hours	Monday-Thursday (9:00-13:00)
7. Course code	
8. Teacher's academic profile	
9. Keywords	Mitosis, heredity, replication, transcription, translation, molecular techniques, gene expression, epigenetics

10. Course overview:

11. Course objective:

Upon successful completion of this course, students should be able to demonstrate the following competencies:

- An understanding of the central theories and methodologies that define the field of genetics and its various subdisciplines (traditional, molecular, and population genetics) and the ability to use the vocabulary that embodies this knowledge;
- To describe the flow of genetic information from DNA to RNA to protein.
 - a. Describe the composition and structure of DNA and the basic steps of DNA replication
 - b. Describe the composition and structure of RNA and the basic steps of transcription
 - c. Describe the composition and structure of protein and the basic steps of translation
 - d. Describe the structure and function of a gene
 - e. Describe examples of human genetic disorders caused by gene mutations and chromosomal rearrangements
- To describe and apply the principles of Mendelian genetics.
 - a. Explain Mendel's Principles of Segregation and Independent Assortment
 - b. Describe the chromosomal basis of inheritance
 - c. Explain linkage, recombination, and the mapping of genes on chromosomes
 - d. Describe non-Mendelian inheritance
- Students will be able to explain how genes are regulated
 - a. Explain the regulation of genes in prokaryotes
 - b. Explain the regulation of genes in eukaryotes
 - c. Describe cell-cycle regulation and the genetics of cancer
 - d. Explain how genetics is used to study development
 - e. Explain the relationship between environmental exposure and cancer genetics
 - Students should be able to explain how mutation occurs
 - a) Explain different types of mutations on DNA level
 - b) Explain different types of mutation on chromosome level
 - c) Understand the relationship of mutation and genetic (inheritance) disease
 - d) Explain different types of mutagens
 - e) Understand the relationship between mutation and cancer development
 - f) Explain what epigenetics is and the role in development of cancer
 - g) External and internal factor that play a role in developing of cancer

12. Student's obligation

Students have to read the given materials as well as sources provided for them ahead of the lecture. they are asked to be well prepared throughout the lecture. They are needed to participate as much as they can, and also have to form groups to discuss topics have been taught in previous lectures or/ and they study every lecture. There are seminars, quizzes, reports, term exams to

finalize their understandings for the subjects they have been taught throughout the course.

lab polices for students:

- 1- Attendance:
 - are strongly encouraged to attend class on a regular basis, as participation is important to your understanding of the material.
 - students 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 lecturer/instructor
- 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.
- Notebook for practical work and notes.
- Whiteboard
- Visits and Fieldwork

14. Assessment scheme

Final grades will be calculated based on the following assignments:

Type of exam	First semester		2 nd semester		Final period exam
	Exam	Activity	Exam	Activity	
Practical exam	7,5	2,5	7,5	2,5	25%
Theory exam	10		10		35%
Total	40 %				60%

- Activity includes: report, quiz, presentation

15. Student learning outcome:

On successful completion of this course, the student will be able to:

1. Describe the fundamental molecular principles of genetics
 2. Understand the structure and function of DNA, RNA and protein
 3. Explain the way in which genes code for proteins
 4. Understand the relationship between phenotype and genotype in human genetic traits.
 5. Describe the basics of genetic mapping
 6. Understand how gene expression is regulated
 7. Understand the genetic basis of cancer
 8. Comprehensive, detailed understanding of the chemical basis of heredity
 9. Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms.
 10. Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
- Understanding the role of genetic mechanisms in evolution.
11. The knowledge required to design, execute, and analyze the results of genetic experimentation in animal and plant model systems.

16. Course Reading List and References:

1. Snyder.L, "Molecular Genetics of Bacteria", Blackwell Publishing Company, Oxford,UK.ThirdEdition(2007).
2. Johnston.J.R, "Molecular Genetics of Yeast - A Practical Approach", Oxford UniversityPress,UKFirstEdition(1994).
3. Primrose.S.BandTwyman.R.M,"PrinciplesofGenomeAnalysisandGenomics", BlackwellPublishingCompany,Oxford,UKThirdEdition(2003).
4. Silver.L.M, "Mouse genetics: Concepts and Applications", Oxford University Press,FirstEdition(1995).
5. Lodish.W.H.H, Berk .A, and Kaiser.C.A, "Molecular Cell Biology", Freeman & Co Ltd.Thirdedition(1995).
6. Watson.J.D, Baker.T.A, Bell.S. P, Gann.A, Levine.M, R.Losick, "Molecular Biology of the Gene",Pearson Education Inc, FifthEdition (2004).

17. The Topics:

In this section the lecturer shall write titles of all topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture

Each term should include not less than 16 weeks

Week	Theory Lecture Topics	Lecturer's name
		Dr.Nzar Theory
1	Introduction to the course genetics	
2	Mitosis	
3	Meiosis	
4	Genetic history and discovery of DNA	

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5	Mendelian Genetics: Monohybrid crosses	
6	Extensions of Mendelian Genetics/ Dihybrid crosses	
7	Chromosome Mapping in Eukaryotes	
8	Sex Determination and Sex Chromosomes	
	Chromosome Mutations: Altered Chromosome Number	
9	Chromosome mutations: changes in the structure	
10	DNA Structure and Analysis	
11	New years Holliday	
13	DNA Replication and Recombination	
14	DNA Organization in Chromosomes	
15	Genetic Organization: Expression and Regulation	
16	Theory exam semester 1	
17	Genetic Code	
18	Translation into Proteins	
19	Gene Mutation and DNA	
20	Gene Expression: Prokaryotes	
21	DNA Replication	
22	Midterm exam	
23	March and Newroz Holliday	
24	Gene Expression: Transcription	
25	Gene Expression: RNA Processing	
26	Gene Expression: Translation	

27	Cancer genetics	
29	Role epigenetics in development of cancer	

18. Practical Topics (If there is any)

In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture

Week	Practical Lecture Topics	
		Lecturer's name Mrs. Zjwan
1	Introduction to practical genetics and safety rules course outline, concept for Genetic	
2	Cell cycle& mitosis: simulation model & video	
3	The Study of Meiosis Division in eukaryotes	
4	Metaphase chromosome preparation	
5	Pedigrees and Probabilities; worksheets	
6	Using of Drosophila melanogaster in genetic research	
7	Mutation induction in Drosophila melanogaster with UV	
8	Observation of mutation in offspring	
9	Polytene chromosome preparation	
10	Project I: human genetic disorder and presentation -select a disorder not discussed in class and do a preliminary selection of two scientific papers related to that disorder.	
11	New years Holliday	
12	X-inactivation, Barr body & Lyon hypothesis	
13	Simple Human Non - Metric Traits: survey	

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14	Karyotyping: worksheets in groups	
15	Molecular Genetics: DNA extraction from human blood/cell culture	
16	Molecular Genetics: quantification methods of purified DNA	
17	Practical exam semester 1	
18	Molecular Genetics: RNA isolation from liver tissue	
19	Molecular Genetics: conventional PCR	
20	Molecular Genetics: gel electrophoresis	
21	Midterm exam	
22	March and Newroz Holliday	
23	Introduction to cell culture techniques	
24	Project II: scientific article that provides some important insight into the inheritance or genetic mechanism of the disorder and molecular	
25	DNA cloning	
26	Blotting and Probing	
27	Chromatography	
28	Visit external lab	
29	Presentation about a molecular technic by groups of students and or poster presentation	

19. Examinations:

- open questions

Explain the process of transcription in eukaryotic cell

- **Multiple choice questions:**

If mother is homozygous dominant and Father heterozygous, what is the probability of their child having brown eyes? (B = Brown eyes, b = blue eyes)

- a) 100% b) 75% c) 50% d) 25% e) 0%

- **Definition:**

Define the following terms: a) homozygous, b) recessive , c) dominant

- **drawing structures:**

Draw the structure of DNA and label all the parts.

20. Extra notes:

21. Peer review

پیداچوونہوہی ھاوہل

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم كۆرسىۋوكە دەبىت لەلايەن ھاوہلئىكى ئەكادىمىيە سەپىر بىكرىت و ناوہرۆكى بابەتەكانى كۆرسەكە پەسەند بىكات و جەند ووشەيەك بنوسىت لەسەر شىاوى ناوہرۆكى كۆرسەكە و واژووى لەسەر بىكات. ھاوہل ئەو كەسەيە كە زانىيارى ھەبىت لەسەر كۆرسەكە و دەبىت پلەي زانستى لە مامۇستا كەمتر نەبىت.

Course Book