Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Genetics

Course Book – (Year 4)

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

Academic Year: 2022/2023

First Semester

Course Book

1. Course name	**Genetics**
2. Lecturer in charge	**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	**SBG 406**
8. Teacher's academic profile	**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.** **My experience:** • **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	**Genetics, Principles of Genetics, Animal Genetics, Plant Genetics, Population Genetics, Sex and Environment, Chromosomal aberrations, Genetic basis of cancer, Molecular biology.**

10. Course overview:

Course description, objectives, and format

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 12 lectures (1st semester) and covers topics are integrated with the concurrent agriculture, medicine, statistics, pathology, and integrated problems.

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.

Course learning objectives

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 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.

Example:

-History of Genetics,1-Blending theory, 2-Acquired character inheritance, 3-Pangenesis theory, 4- Performation and Epigenesis, 5-Cell theory (Classical and modern interpretation)

-The subject matter of genetics includes: Heredity; The molecular nature of the genetic material; The ways in which genes, which determine the characteristics of organisms, control life functions; The distribution and behavior of genes in populations.

-Genetics four major subdisplines: Transmission Genetics; Molecular Genetics; Population Genetics; Quantitative Genetics

- Gene Expression, Genome, chromatin, chromosome, Gene (Mendelian factor), Allele, Homozygous, Heterozygous, Genotype, Phenotype.

Characteristics of Organisms Used for Genetic Studies, General Features

-Viruses, *Eschirichia.coli*, Human, *Drosophila melanogaster*, Maize, *Arabidopsis thaliana*.

-Methods of genetic study, 1- Planned breeding, 2- Pedigree analysis

-Why do Pedigrees? Goals of Pedigree Analysis, Symbols used in pedigree analysis

-Autosomal recessive trait, Autosomal dominant trait

-Complete dominance, -incomplete dominance, Codominance, Overdominance, Heterosis.

-Lethal genes, a-Dominant genes with recessive lethal effect, b- Recessive gene with recessive lethal effect.

- Multiple alleles

- Multiple genes (Polygeny)

- Qualitative genetics

-Quantitative traits

- Epistasis, epistatic gene, hypostatic gene, Types of epistasis, Classical ratio, Dominant epistasis, Recessive epistasis, Duplicate genes with cumulative effect, Duplicate dominant genes, Duplicate recessive genes, Dominant and recessive interaction.

12. Assessment scheme

Examinations

There will be at least one obligate exam through the semester, the exam will contain multiple-choice, true-or-false, short answer questions, long answer questions, give the reasons, solving the problems, make the diagram, etc.

Quizzes and weekly assignments:

The exam has (10) marks, the practical exam has (35) marks, so the final grade will be based upon the following criteria:

Mean of two examinations: 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 pattern of inheritance.**
- **Have knowledge of several Mendelian and chromosomal conditions.**
- **Recognize the genetic and environmental contribution to multifactorial conditions.**
- **To know the genetic and environmental basis of sex determination.**
- **Learned approaches which can be used for the diagnosis of genetic disease and carrier detection.**
- **Learned different forms of DNA testing (prenatal diagnosis, predictive testing, and diagnostic testing).**
- **Be familiar with the practice of the genetic counseling.**
- **Know when and where to get genetic advice and information.**
- **Be familiar with the major ethical issues.**
- **To know the effects of cytoplasmic inheritance.**
- **To know the population genetics and the factors affects the gene frequency in the population.**

14. Course Reading List and References:

1- Tamarin, R.H. (2004). Principles of genetics (7th Edition). Wm. C. Brown publisher. U.S.A

2- Brooker, Robert J. (2021). Genetics: Analysis and Principles (7th Edition). Mc Graw Hill. U.S.A

6- Pierce B.A. (2020). Genetics, A Conceptual Approach (7th Edition). 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**
History of genetics	**History of genetics, the genetic theories, the subject matter of genetics includes, genotype and phenotype**
Mendelian inheritance	**Gregor Mendel (1822-1884), Genetic terminology, Punnett square, Mendel's experimental methods, Mendel's 1st and 2nd laws, test cross and back cross**
Characteristics of Organisms Used For Genetic Studies	**Viruses, *E.coli*, Human, Drosophila, maize, Arabidopsis thaliana, methods of genetic study, pedigree analysis**
Type of dominance	**Dominant/ recessive, incomplete dominance, Codominance, Overdominance, Lethal genes, Multiple alleles (Polygenic inheritance)**
Epistasis	**Dominant epistasis (12:3:1), Recessive epistasis (9:3:4), Duplicate genes with cumulative effect (9:6:1), Duplicate dominant genes (15:1), Duplicate recessive genes (9:7), Dominant and recessive interaction (13:3), Gene interactions (non-epistatic interaction)**
Sex-determination system	**Genetic mechanisms of sex determination, chromosomal basis of sex determination, Genic balance**
Exam.	
Sex Determination and Environment	**Haplodiploidy, Single gene effect, Sex determination and environment**
Inheritance related to sex (X-linked recessive and dominant traits)	**Variation of sex-linkage, Pseudoautosomal Inheritance, Sex linked in Drosophila, Criteria for an X-linked recessive trait and examples, Criteria for an X-linked dominant trait and examples.**
Y-linked traits,	**Y-linked inheritance and their examples, Sex influenced traits, sex limited traits**

Sex influenced traits, sex limited traits	**and their examples**
Linkage and recombination	**Work of Bateson and Punnett, Coupling and repulsion, Linkage, Crossing over, Factors affecting crossing over, Methods of calculation of crossing over, Complete linkage, Mapping Genes**
Cytoplasmic inheritance	**Organelle heredity, Infectious heredity, Maternal effect**
Chromosome aberrations, variation in chromosome number	**History of cytogenetics, classification of chromosomes, aneuploidies of the sex chromosomes, aneuploidies of the somatic chromosomes, aneuploidy vs polyploidy**
Variation in chromosome structure	**Deficiencies/Deletions; Duplications The genetic material remains the same, but is rearranged; Inversions; Translocations and their examples**
Population genetics	**Defenition, Hardy-Weinberg principle and population equilibrium, Applying the Hardy-Weinberg Principle**
Changes in Gene Pools	**Genetic drift, mutations, natural selection, non-random mating**
Introduction to cloning and recombinant DNA technology	**DNA cloning, DNA sequencing, detection of disease genes, Polymerase chain reaction (PCR)**
Genetics of cancer	**Cancer is a genetic disease, cell cycle regulation and cancer, predisposition to cancer, causes of cancer, cancer and environment**

16. Examinations:

1. Compositional: In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?

With their typical answers

Examples should be provided

Question/ Why do Pedigrees? Punnett squares and chi-square tests work well for organisms that have large numbers of offspring and controlled mating, but humans are quite different:

1. **Small families. Even large human families have 20 or fewer children.**
2. **Uncontrolled matings, often with heterozygotes.**
3. **Failure to truthfully identify parentage.**

2. True or false type of exams:

In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided

Q1/Write True and False in front of the following sentences, then correct the false. (15 Marks)

1-Although incorrect, the concept of pangenesis was highly influential and persisted until the late 1900s.

2- The genetic and molecular organization of the mouse and human genes are quite similar.

Answers/1-F/1900 ---T/1800, 2-T.

3. Multiple choices:

In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided.

Question/ For each term in the left column, choose the best matching phrase in the right column.

				Answer
A	Karyotype	1	Crosses in which the male and female traits are reversed, thereby controlling whether a particular trait is transmitted by the egg or the pollen	A-4
B	Reciprocal crosses	2	The cross of an individual of ambiguous genotype with a homozygous recessive individual	B-1
C	Population genetics	3	Which deals with heredity in groups of individuals for traits that are determined by one or only a few genes	C-3
D	Test cross	4	The array of chromosomes in a given cell	D-2

Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Practical Genetics

Course Book – (Year 4)

Lecturer's name Govand Musa Qader, M.Sc.

Academic Year: 2022/2023

First Semester

Course Book

1.Course name	**Genetics Pratcical**
2. Lecturer in charge	**Govand Musa Qader**
3. Department/ College	**Biology department/ College of Science**
4. Contact	**e-mail: govand.qader@su.edu.krd**
5. Time (in hours) per week	**Practical: 6**
7. Course code	**SBio 406**
8. Teacher's academic profile	**•I graduate from Salahaddin University/ College of Science/ Biology department in 2007.** **• In 2014 I completed my M.Sc. degree and after a year (in 2015) started as Assistant Lecturer Teaching Practical molecular technique, and Practical Genetics and Practical entomology in the same college.** In 2021 i promoted to lecturer. **The teaching experience in practical including:** **Undergraduate:** 1- Practical Genetics 2- Practical biotechnology 3- Practical molecular technique 4- Practical Entomology
9. Keywords	Genetics, Molecular biology.

11. Course objective:

Different forms of teaching will be used to reach the objectives of the course: power point presentations for the head titles and definitions and any other illustrations, besides worksheet will be designed to let the chance for practicing on several aspects of the course in the classroom. There will be classroom discussions and the lecture will give enough background to translate, solve, analyze, and evaluate problems sets, and different issues discussed throughout the course.

To get the best of the course, it is suggested that you attend classes, read the required lectures, teacher's notes regularly as all of them are foundations for the course. Try as much as possible to participate in classroom discussions, preparing the assignments given in the course

12. Student's obligation

- Students should attend all lectures and not miss any lecture time.
- Additionally, for each lecture, the student should prepare and follow up with sufficient studying time to cover the material presented in the class during that lecture.
- It is highly advised not to accumulate material until before the examination time. Cramming will definitely weaken the student's ability to understand and retain valuable information.
- Students prefer to attend all the seminars on time which held in our department especially seminar about hematology.

13. Forms of teaching

Teaching with technology can deepen student learning by supporting instructional objectives.

- Data Show Projector
- Blackboard
- Video

14. Assessment scheme

Breakdown of overall assessment and examination

Grading System:

Theory: 15 %
Practical: 30%

weekly quizzes:5%

Total =35 %

16. Course Reading List and References:

1. Kaplan, B.J. (1978) *Preparation of the normal karyotype (workbook). hicago: American Society of Clinical Pathologists.*
2. Macgregor, H.C. & Narley, J.M. (1983). Working with animal chromosome. NewYork: John Wiley & Sons
3. Hartl, D.L. and Jones, E.W. (2000). Genetics. Analysis of Genes and Genomes. Fifth Edition. Jones and Bartlett Publishers, Boston.
4. Mertens, T.R. & Hammersmith, R.L. (2001). Genetics: Laboratory Investigations. Twelfth Edition. Prentice Hall, Englewood Cliffs, NJ.

The Topics:

Week 1:
Introduction, course outline, concept for Genetic terms

Week 2:
The cell cycle and mitosis

Week 3:
The Study of Meiosis Division in eukaryotes

Week 4:
Using of ***Drosophila melanogaster*** in genetic research

Week 5:
Polytene chromosome preparation

Week 6:
Mutation induction in ***Drosophila melanogaster***

Week 7:
Using Chromatography to Identify the Eye Mutation of ***Drosophila melanogaster***

Week 8
X-inactivation, Barr body & Lyon hypothesis

Week 9:
Fingerprints & Palmar Dermatoglyphics

Week 10:
Simple Human Non - Metric Traits

Week 11:
Metaphase chromosome preparation

***Week 13*:** Examination