Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Cytogenetics

Course Book – Year 4

Lecturer names:

Khder Hussein Rasul, PhD/ Theory

Mustafa Fahmi Rajab, M.Sc./ Practical

Abdullah Abubaker Shareef, M.Sc./ Practical

Academic Year: 2023-2024

Course Book

1. Course name	**Cytogenetics**
2. Lecturer in charge	**Dr. Khder Hussein Rasul (Theory)** **Mustafa Fahmi Rajab, M.Sc. (Practical)** **Abdullah Abubaker Shareef, M.Sc./ Practical**
3. Department/ College	**Department of Biology/College of Science**
4. Contacts	**E-mails: khder.rasul@su.edu.krd** **Mustafa.rajab@su.edu.krd** **abdullah.shareef@su.edu.krd**
5. Time (in hours) per week	**2 hrs theoretical & 6 hrs. practical supervision**
6. Office hours	**TBD**
7. Course code	**Cytogenetics**
8. Teacher's academic profile	**Khder Hussein Rasul** I graduated from Salahaddin University in 2007 (Ranked 1st in college), first, I worked as assistant of biology for two years and assist in practical Immunology lab., practical virology lab., practical physiology lab., practical molecular biology lab. At the end of 2011, I finished my M.Sc. degree in cell biology and have started as assistant Lecturer, teaching practical cell biology and microtechnique. My scientific title changed to lecturer on September 2016 by submitting 3 research articles From 2016-2019, I worked in Zanco Journal as editor. PhD in molecular genetics, October 2022 **Mustafa Fahmi Rajab Academic Profile** • 2020- Now: Teaching as Assistant lecturer at Salahaddin University - Biology Department • 2018- 2020: Working as biology assistant in Salahaddin University- College of Science, Biology department. • 2015-2018: Master degree in Genetics and Molecular Biology in both Ankara University and Middle East Technical University in Ankara /Turkey. GPA 3.78/4, (93.40% /100%) • 2013-2015: Working as biology assistant in Salahaddin University /college of science /Biology Department, Erbil- Iraq. • 2009-2013: BSc in Biological science at Salahaddin University. Rank (3) over whole University students. Average grade: 86.3% /100%. • 2003-2009: Studied preparatory school in Hawler Typical Secondary School in English language.

9. Keywords	**Karyotype, FISH, Q-Banding, Chromosome.**

10. Course overview:

"A study of different aspects of the cell which affect inheritance."
The purpose of the course is to provide a working knowledge of cytogenetics, the preparation of materials for study, and the importance of chromosomal variations in structure and number in such fields as plant and animal breeding, population genetics, evolutionary genetics, taxonomy, and the medical sciences.
The student will be able to recognize, describe and discuss in detail the different aspects of chromosomal structure, number, and behavior, and their effects at the organismal, population and species levels. They will describe and discuss this material in detail on two essay lecture exams, demonstrating their mastery of the material.

11. Course objective:

The course provides insight into the structure and number of chromosomes using microscopic analysis. For instance a decrease or an increase in the chromosomal number or translocation of one to another chromosome or even chromosome behaviour during mitosis and meiosis. Haploidy and its applications in genetics and plant breeding are studied in detail. Additionally the course provides insight on chromosome mapping approaches in modern genomics, polyploidy and cytogenetic aspects of crop evolution.

12. Student's obligation

***Classroom polices:**

1- Attendance: students are strongly encouraged to attend in class on a regular basis, as participation is important to understanding of the material. This is student's opportunity to ask questions. **Students are responsible for obtaining any information during the class which provided.**

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 and don't allow to use internet.

4-Talking: During class please refrain from side conversations. These can be disruptive to your fellow students

***Exam policy:** Student Should take at least one exam during the course; There will be no make-up exams for absences students without medical report.

13. Forms of teaching

PowerPoint presentation, board, videos, in class activities, and sample identification

14. Assessment scheme

Breakdown of overall assessment and examination

Pre final (50 marks)

Theory (15 marks)

Exam = 10 marks

Quizzes, seminar, homework and attendance = 5 marks

Practical (35 marks)

Exam 15

Quiz 6

Report 8

Assignment 6

Final

Theory (50 marks)

15. Student learning outcome:

By completing this course, the students can:

1. Become familiarized with scientific vocabularies used in the science of cytogenetics.
2. Be able to describe general structure of chromosomes.
3. Understand how cellular mechanisms work in creating abnormalities in chromosomes which lead to diseases.
4. Understanding some techniques which are used to study chromosomal aberrates

16. Course Reading List and References:

Theory:

Gersen, Steven T. and Martha B Keagle. 2005. The principles of clinical cytogenetics. Second edition. Human press. Totowa, New Jersey.

Practical:

Haldar, Arpan. 2020. Notes on Cytogenetics and techniques in Medical Genetics. Sara Book Publication.

17. The Topics:	Timeline
An Introduction to Medical Cytogenetics	Week 1
Heterochromatin, euchromatin, and the nucleosome	Week2
Structure and function of chromosomes	Week3

Banding Pattern	Week4
Variations in chromosome structure	Week5
Changes in chromosome number	Week6
Epigenetic mechanisms	Week7
Exam	Weeks8
Genomic Imprinting disorders	Week9
Single Gene Disorder	Week10
Prenatal Testing and Reproductive Genetics	Week11
Hemoglobin And Hemoglobinopathies in Genetics	Week12
Genetic Factor in Common Disease	Week13
Genetic Disease Therapies	Week14
Genetic Counselling and Ethical issues	Weeks 15
18. Practical Topics	
Course introduction: a brief history of cytogenetics	**Week One**
Sample collection, Culture, and Harvest	**Week Two**
Human Chromosomal Nomenclature	**Week Three**
Banding techniques, G, Q, R, Banding technique	**Week Four Quiz 1(Lab 2&3)**
Cytogenetic techniques (Bone marrow sample preparation & Lymphocyte Culture technique)	**Week Five (Report 1)**
Techniques that Stain Selective Chromosome Regions (C-Banding, T-Banding, Cd-Banding, Nor Banding, G-11 Banding, DAPI/DA method)	**Week Six (Poster presentation)**
Molecular cytogenetics methods-FISH, CGH, SKY, etc.	**Week Seven Quiz 2(Lab 4,5&6)**
Exam	**Week Eight**
Scientific Trip	**Week Nine (Report 2)**
Seminar presentation	**Week ten (Seminar activity)**
Genomic microarray technologies for the cytogenetics laboratory	**Week eleven (Quiz3 Lab 11)**
Prenatal chromosome diagnosis NIPT Test	**Week twelve**
The Cytogenetics of Infertility	**Week Thirteen**

Selected topics on safety, equipment maintenance, and compliance for the cytogenetics laboratory	**Week Fourteen** **Quiz 4 (lab 12,13,14)**
Immunohistochemistry technique and its application.	**Week Fifteen**
Scientific Trip	**Week Sixteen**

19. Examinations:

Theory:

Exams will be mixture of the following styles:

1. Multiple choice
2. Short assay
3. True or false
4. Drawing

During Answering: the student should:

1. Understand the questions.
2. Answer the questions asked during the assigned exam time.
3. Answer should be precise.

Examples of exam questions

- Cytogenetics is defined as .....

A. Branch of genetics B. structural of chromosomes C. none of a or b D. both a and b

- What are chromosomal abnormalities?
- What are the effects of mutagens on chromosomes?

Practical:

1. I identify: include instruments, materials, cell shape….etc

Example: Identify the following

- Answer: Plastic block

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

Example: What do you know about osmium tetroxide?

- Answer: Osmium tetroxide is act as strainer and fixative which use in Routine TEM

3. 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.

Example: The main part of the cell, which determines the cell shape, is cytoskeleton.

- Answer: True

4. 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.

20. Extra notes:

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21. Peer review پێداچوونەوەی هاوەڵ

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 کۆرسبووکە دەبێت لەلایەن هاوەڵێکی ئەکادیمیەوە سەیر بکرێت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند ووشەیەک بنووسێت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.

هاوەڵ ئەو کەسەیە کە زانیاری هەبێت لەسەر کۆرسەکە و دەبیت پلەی زانستی لە مامۆستا کەمتر نەبێت.

Peer reviewed by:

Lecturer M. Muhammed Ali Salim

Head of Biology Department