



Department of Biology

College of Science

Salahaddin University - Erbil

Subject: Cytogenetics

Course Book – Year 4

Lecturer names:

Trefa Salih Mohamad, PhD/ Theory

Mustafa Fahmi Rajab, M.Sc./ Practical

Abdullah Abubaker Shareef, Msc./ Practical

Academic Year: 2022-2023

Course Book

1. Course name	Cytogenetics
2. Lecturer in charge	Dr. Trefa Salih Mohamad (Theory) Mustafa Fahmi Rajab, M.Sc. (Practical) Abdullah Abubaker Shareef, MSc. (Practical)
3. Department/ College	Department of Biology/College of Science
4. Contacts	E-mails: trefa.mohamad@su.edu.krd Mustafa.rajab@su.edu.krd Abdudullah.shareef@su.edu.krd
5. Time (in hours) per week	Dr. Trefa Salih Mohamad: 2 hrs theoretical & 6 hrs. practical supervision
6. Office hours	TBD
7. Course code	Cytogenetics
8. Teacher's academic profile	<p>Trefa Salih Mohamad, Ph.D. in Biology/Molecular Biology and Microbiology EDUCATION</p> <p>1. Department of Biochemistry and Molecular Biology, School of Medicine, Southern Illinois University at Carbondale, Illinois, USA. PhD in Molecular Biology and Microbiology/ Mar 2011-May 2017 Dissertation title: EARLY GROWTH RESPONSE 1 (EGR1) AS A TUMOR SUPPRESSOR AND APOPTOSIS INDUCER IN RHABDOMYOSARCOMA. <i>Supervised by:</i> Dr Judith Davie.</p> <p>2. Department of Biology, College of Science, Salahaddin University-Erbil, Erbil, Iraq. MSc in Biology/Molecular Biology May 2005-Jul 2009</p> <p>SCHOLARSHIP</p> <ul style="list-style-type: none"> PhD scholarship by the Higher Committee for Education Development in Iraq (HCED) (6 years). <p>Mustafa Fahmi Rajab Academic Profile</p> <ul style="list-style-type: none"> 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.
<p>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.</p>	
<p>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.</p>	
<p style="text-align: center;">12. Student's obligation</p> <ul style="list-style-type: none"> • Attendance will be taken in the first 5min of each lecture. During which if you are not present, you will be recorded as an absentee. • The students are required to keep their mobile devices quiet at all times during the lectures. • The students are expected to remain respectful and civil to their fellow students. • Any verbal and/or written form of cheating is not tolerated. • The exams once set, will not be postponed. You will be reminded with a note on the students’ note-board several days before the exam. • English language is used in the lectures. Students are expected to answer exam questions in English language, only. <p>Students lab obligations:</p> <p>Exam policy: Student Should take 2 exams during the course; There will be no make-up exams for absences students without medical report.</p> <p>Quizzes: students are quizzed every week.</p> <p>Seminar: during the course, the student will do seminar.</p>	
<p style="text-align: center;">13. Forms of teaching</p> <p style="text-align: center;">PowerPoint presentation, board, videos, in class activities, and sample identification</p>	
<p style="text-align: center;">14. Assessment scheme</p> <p>Student assessment will be based on scores obtained in the written exams. There will be at least two written exams. The scores will be announced as one annual quest grade on 20 (15 theoretical+ 35 practical).</p>	

Assessment scheme

Practical (35 marks)

Exam 25pts

Quiz 4pts

Seminar 3pts

Homework and class activity 3pts

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. To learn basic techniques of slide preparations of microstructures that may subsequently be studied with a compound microscope.
4. Understand how cellular mechanisms work in creating abnormalities in chromosomes which lead to diseases.
5. 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 Genetics/Cytogenetics	Week 1
Heterochromatin, euchromatin, and the nucleosome	Week2
Cytogenetics: 1. Structure and function of chromosomes. - chemical composition, telomeres, centromeres and kinetochores, nucleolar organizers, chromomeres, euchromatin and heterochromatin, unique and repetitive DNA, chromosome structure throughout the cell cycle, banded chromosomes.	Week3
Endomitosis and polyteny, molecular mechanism of crossing over, chromosomal evidence of crossing over, environmental and genetic factors which affect the frequency of crossing over, genetic control of meiosis.	Week4

Variations in chromosome structure: The origin and adaptive significance of duplications, deletions, inversions, and translocations, isochromosomes, ring chromosomes, centric fusions and fissions.	Week5
Changes in chromosome number - aneuploidy and euploidy in both plants and animals, their origins, cytogenetic effects, use in crop breeding, and adaptive significance.	Week6
CANCER CYTOGENETICS	Week7
Examination 1	Weeks8
Epigenetic mechanisms and Genomic Imprinting disorders	Week9
The cytoskeleton structure	Week10
Cell cycle	Week11
	Week12
	Week13
	Week14
Examination 2	Weeks 15
18. Practical Topics	
Course introduction: a brief history of cytogenetics (coursebook description)	Week One
Cell cycle and cell division (mitosis and meiosis)	Week Two
Sample collection, culture, and harvest	Week Three
Chromosomal Nomenclature (Banding patterns:- Q-Banding, G-R-C Banding, NOR Banding)	Week Four
Cytogenetic techniques (Bona marrow sample preparation & Lymphocyte Culture technique)	Week Five
Polytene chromosomes, their preparation and analysis. Preparation of materials for the following laboratory.	Week Six
G-Banding technique	Week Seven
Q, R, C-Banding techniques	Week Eight
Poster Presentation (student learning Center)	Week Nine
Molecular cytogenetics methods-FISH, CGH, SKY, etc.	Week ten
Microarray and NIPT Test	Week eleven
Cancer Biology	Week twelve
Examination 2	Week Thirteen
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:

21. Peer review پيداچووننهوهى هاوهل

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 كۆرسىبووكە دەپتت لەلايەن هاوهلىكى ئەكادىمىيە سەپىر بىكرىت و ناوهروكى بابىتەكانى كۆرسەكە پەسەند بىكات و جەند ووشەپەك بنووسىت لەسەر شىاوى ناوهروكى كۆرسەكە و واژووى لەسەر بىكات.

Peer reviewed by:

Lecturer M. Muhammed Ali Salim

Head of Biology Department