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**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**

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| **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 Chemistry/College of Science** | |
| **4. Contacts** | **E-mails:**  **trefa.mohamad@su.edu.krd**  [**Mustafa**.rajab**@su.edu.krd**](mailto: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** | **Trefa Salih Mohamad, Ph.D. in Biology/Molecular Biology and Microbiology**  **EDUCATION**  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*. Supervised by***:** Dr Judith Davie.    2. Department of Biology, College of Science, Salahaddin University-Erbil, Erbil, Iraq.  **MSc in Biology/Molecular Biology May 2005-Jul 2009**  **SCHOLARSHIP**   1. PhD scholarship by the Higher Committee for Education Development in Iraq (HCED) (6 years). | |
| **9. Keywords** | **Cell investigation, structure, internal organization, regulation, function** | |
| “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. | | |
| 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**   * 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.   **Students lab obligations:**  **Exam policy:** Student Should take 2 exams during the course; There will be no make-up exams for absences students without medical report.  **Quizzes:** students are quizzed every week.  **Seminar:** during the course, the student will do seminar. | | |
| **13. Forms of teaching**  PowerPoint presentation, board, videos, in class activities, and sample identification | | |
| **14. Assessment scheme**  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). | | |
| **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) | |  |
| Sample collection, culture, and harvest | | Week Two |
| Chromosomal Nomenclature | | **Week Three** |
| Cytogenetic techniques (Bona marrow sample preparation) | | **Week Four** |
| Polytene chromosomes, their preparation and analysis. Preparation of  materials for the following laboratory. | | **Week Five** |
| G-Banding technique | | **Week Six** |
| Q, R, C-Banding techniques | | **Week Eight** |
| Poster Presentation (student learning Center) | | **Week Nine** |
| Immunohistochemistry technique and applications in cell biology research. | | **Week ten** |
| Molecular cytogenetics methods-FISH, CGH, SKY, etc. | | **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 ................  1. 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 پێداچوونه‌وه‌ی هاوه‌ڵ**  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).*  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | | |

**Peer reviewed by:**

**Lecturer M. Muhammed Ali Salim**

**Head of Biology Department**