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**Department of Animal Resources**

**College of Agricultural engineering sciences**

**Salahaddin University - Erbil**

**Subject:Molecular Genetics (Practical)**

**Course Book – (Year, 2)**

**Lecturer's name: Asst. Lecturers:**

**DilgerMaghdedKhdr (M.Sc. + PhD Student)**

**Kamaran Mustafa Taha (M.Sc.)**

**Academic Year: 2022/2023**

**Course Book**

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| **1. Course name** | **Practical Molecular Genetics** |
| **2. Lecturer in charge** | **Asst. Lecturer. DilgerMaghdedKhdr****lecturerKamaran Mustafa Taha** |
| **3. Department/ College** | **Animal Resources/ Agricultural engineering sciences**  |
| **4. Contact** | **e-mail:****dilger.khdr@su.edu.krd****Tel:07507497808****Kamaran.taha@su.edu.krd****Tel: 009647504256447** |
| **5. Time (in hours) per week**  | **Practical: 3** |
| **6. Office hours** | **4 days/ week / in reporter’s room office**  |
| **7. Course code** |  |
| 8. Teacher's academic profile  | They hold a bachelor's degreeat Salahaddin University - College of Agricultural Engineering Sciences - Department of Animal Resources.They hold a Master in (Genetics &molecular genetics) respectively atSalahaddin University College of Agricultural Engineering Sciences - Department of Animal Resources.Mrs. Dilger is a PhD student and Mr. Kamaran is a reporter in animal resources department. |
| **9. Keywords** | **DNA, RNA, solutions, electrophoresis, agarose, PCR, Restriction Enzyme, DNA sequencing** |
| **10. Course overview:** Molecular genetics is the study of molecular underpinnings of the process of replication, transcription and translation of the genetic material. The central dogma of molecular biology where genetic material is transcribed into RNA and then translated into protein, despite being an oversimplified picture of molecular biology, still provides a good starting point for understanding the field. This picture, however, is undergoing revision in light of emerging novel roles for RNA. Much of the work in molecular biology is quantitative, and recently much work has been done at the interface of molecular biology and computer science in bioinformatics and computational biology. As of the early 2000s, the study of gene structure and function, molecular genetics, has been amongst the most prominent sub-field of molecular biology. One of the most basic techniques of molecular biology to study protein function is expression cloning. In this technique, DNA coding for a protein of interest is cloned (using PCR and/or restriction enzymes) into a plasmid (known as an expression vector). This plasmid may have special promoter elements to drive production of the protein of interest, and may also have antibiotic resistance markers to help follow the plasmid. |
| **11. Course objective:**Molecular genetics is the study of biology at a molecular level. This field overlaps with other areas of biology and chemistry, particularly genetics and biochemistry. Molecular genetics chiefly concerns itself with understanding all practical stages in laboratory starts from solution preparation; DNA extraction agarose electrophoreses and so on as well as learning how these techniques are regulatedandapplied to animal productions |
| **12. Student's obligation**The role of students & their obligations throughout the academic Semester will be:the attendance, scientific discussion, completion of all tests, exams, reports. |
| **13. Forms of teaching**Different methods of teaching will be used to reach the objective of the coarse including: power point presentation for the head title, definition, discussion, questions, and whiteboard at request as well as doing practical work in laboratory and practical exams and quizzes. |
| **14. Assessment scheme**- Marks distribution of 35%

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| Test | Mark 35% |
| 1st Exam | 15 |
| 2st Exam | 15 |
| Quizzes and Reports | 5 |
| Total | 35 |

Final examination (**NO**) |
| **15. Student learning outcome:**At the end of course graduates should be familiar with practical molecular genetics, and their application in animal production, enhancing their health and immune against diseases.Graduates should utilize all the above knowledge to manage and take care of farm animals in order to improve production (meat, milk, wool & hair) genetically: quantitatively and qualitatively. Thus will be worthwhile for the future development of the growers in the region, which leads to increase the national income and consequently, to ensure food security. |
| **16. Course Reading List and References‌:**Introduction to molecular biology" Paollela ,P.. McGraw – Hill .USA "Molecular biology " Weaver, R.F.3rd ed."Cell and molecular biology" karp, G.3rd ed.Molecular Biology and genetic engineering maharani 2010 india. |
| **17. The Topics:** | **Lecturer's name** |
| First week: safety& laboratory equipment Second week: solution preparationThird week: DNA extractionFourth week: agarose gel electrophoresisFifth week: PCR Sixth week: restriction enzymesSeventh week: DNA sequencingEighthweek: ELISANinth week : Linkage and MappingTenth week: MutationEleventh week : Thin Layer Chromatography12th& 13th weeks: Practical application of animal production | Lecturer's nameAsst. Lecturers: Mrs. DilgerMaghdedKhdrMr. Kamaran M. Taha3 hours for each week |
| ***19.*** *Typical questions:****Practical questions are more preferred.*****Write functions of the following terms?****Autoclave, pH meter, Gel loading dye, Power supply****Q2) Answer the following:** **A)Why use extraction bufferin the DNA extraction methods?** **B) How many grams of Tris-HCl would you need to prepare 60mL of a (0.5M) solution? The Molecular weight of Tris-HCl is 121.1 g/mol.****Answer the following?****A)** Why should be careful with the Phenol, Acrylamide, and Ethidium bromide?**B)**What are the major factors of travel of the particle in gel Electrophoresis?**Q2)Answer the following:** **A)** Why use extraction buffer and SDS (20%) in the DNA extraction methods? **(10 Marks)****B)** Calculate how many mL of a (1.0 M) stock solution of NaCl are needed to prepare100 mL of a (50 mM) solution. **Choose the correct answer.** 1. The DNA used in a PCR reaction is called the: **(Building Blok, Buffer, Templet)**
2. During the annealing step **(Primers bind to the newly separated DNA strand, The two DNA strands separate at high temperatures, The DNA and master mix are added together).**
3. When DNA copies are multiplied at a rapid rate, this is referred to as\_\_\_ amplification**. (Exponential, Quick, Moderate, Templet).**
4. Primers generally consist of--------- nucleotides. **(20, 50, 60, 14).**
5. How many cycles of PCR do you need to get (60 copies) of untargeted DNA.

 **(25, 30, 35,40).****Answer the following questions**What is Indirect ELISA?Write only all types of ELISA?Fill the blanks in following picture?**Q)The following is the DNA sequence of Gene K that you want to amplify using the polymerase chain reaction (PCR). (25 Marks)**5’CTCGAGGTGAATATGAAAG---- ----CATTTGGCGCGTAATCGATA3’ 3’ GAGCTCCACTTATACTTTC---- ----GTAAACCGCGCATTAGCTAT5’**Gene K****a) Circle the set of primers from the options below, which you would use for PCRreaction. Why? (10 Marks)**Set 1: 5’CTTATACTTT3’ and 3’GTAAACCGGAT5’ Set 2: 5’GAGTTACCC3’ and 3’TGGCGAGTATC5’Set 3: 5’GGTGAATAT3’ and 3’CCGCGCATTAG5’**b) Restriction enzymes are extensively used in molecular biology. Below are the recognition sites of two of these enzymes, SacI and SchZI.****You are given the DNA shown below.**  **5’ ATTGAGGAGCTCCGTAATGGTCCCCGCGGCGCTCCACG 3’** **3’ TAACTCCTCGAGATTACACGGACGGCGCCGGCAGGTGC 5’**  **1) SacI, cleaves after the T. Does cleavage by SacI result in a 5’ or 3’ overhang? If this DNA was cut with SacI, how many DNA fragment would you expect? Write out the sequence of these double-stranded DNA fragments.****2) SchZI cleaves after the third C. Does cleavage by SchZI result in a 5’ or 3’ overhang? If this DNA was cut with SchZI, how many DNA fragment would you expect? Write out the sequence of these double-stranded DNA fragments.****If you know the recognition site for SchZI is 5’ CCGCGG 3’ / 3’ GGCGCC’ 5,** **and for SacI is 5’ GAGCTC 3’ / 3’ CTCGAG 5’** |
| **20. Extra notes:**Best wishes for all students (understanding the question = half the answer) |
| **21. Peer review**  |