EL CAMINO COLLEGE
COURSE OUTLINE OF RECORD - Approved

Course Acronym:	BIOL
Course Number:	130
Descriptive Title:	Fundamentals of Molecular Biology
Division:	Natural Sciences
Department:	Biology
Course Disciplines:	Biological Sciences
Catalog Description:	This course is an introduction to molecular biology. The student will study DNA, RNA and protein structure; protein biochemistry; protein purification and analysis; genome organization of viruses, prokaryotes and eukaryotes, DNA replication; transcription and splicing; regulation of transcription; translation; and recombinant DNA technology. The student will also explore the uses of DNA technology, such as forensics and agriculture, as well as the ethical considerations of these uses.
Prerequisite:	Biology 110 or Biology 110H AND Biology 120 or Biology 120 H with a minimum grade of C in each course AND Chemistry 7A with a minimum grade of C or concurrent enrollment
Course Length:	Full Term
Hours Lecture (per week):	3
Hours Laboratory (per week):	0
Outside Study Hours:	6
Total Course Hours:	54
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	1/20/1998
Transfer UC:	Yes
Effective Date:	
General Education: ECC	Area 1 - Natural Sciences
Term:	
Other:	
CSU GE:	Area B2 - Physical Universe and its Life Forms: Life Science
Term:	
Other:	
IGETC:	Area 5B - Biological Science
Term:	
Other:	

Student Learning Outcomes:	**SLO #1 Scientific Method** The student will understand and apply principles of the scientific method; recognizing an idea based on reproducible evidence. **SLO #2 Content Knowledge (Central Dogma)** The student will be able to provide a detailed explanation of how the unit-by-unit transfer of genetic information occurs from DNA to RNA to Protein. **SLO #3 Content Knowledge (Control of Gene Expression)** The student will be able to explain various prokaryotic and eukaryotic gene expression control mechanisms.
Course Objectives:	1. Compare and contrast the structures and functions of DNA and RNA. 2. Describe the basic building block, the amino acid, of proteins. 3. Explain the properties of the twenty amino acids and know the three letter and one letter abbreviations for each amino acid. 4. Compare and contrast the four levels of protein structural organization. 5. Identify major post-translational modifications. 6. Describe techniques used in protein purification and analysis. 7. Compare and contrast the genomes of viruses, prokaryotes, and eukaryotes. 8. Compare and contrast DNA replication in eukaryotes and prokaryotes. 9. Discuss initiation, elongation, and termination of transcription and translation. 10. Describe the major modifications at the 5' and 3' ends of eukaryotic mRNAs, explain how they arise, and state their importance. 11. Explain mechanisms underlying intron removal and alternative splicing. Discuss the importance of alternative splicing in generating diversity of gene products. 12. Describe the regulation of gene expression at the transcriptional level in prokaryotes and contrast this with eukaryotic transcriptional control. 13. Discuss post-transcriptional, translational, and post-translational controls of eukaryotic gene expression. 14. Explain key differences between eukaryotic and prokaryotic protein synthesis. 15. Provide an integrated overview and explain the importance of the flow of information from DNA to RNA to protein. 16. Describe tools and techniques used in nucleic acid study including recombinant DNA technology and gene cloning. 17. Compare and contrast varied applications of DNA technologies from forensic uses to the generation of genetically modified organisms for agricultural, pharmaceutical, and research based purposes. 18. Discuss ethical considerations involving the use of DNA based technologies eukaryotic.

Major Topics:	**I. Introduction: Class organization; Requirements Review: Scientific Method (1.5 hours, lecture)** **II. Review: Cellular Structure (3 hours, lecture)** **III. Central Dogma of Molecular Biology (Biological Information Flow) (1.5 hours, lecture)** **IV. Structure of Protein; Protein Biochemistry (4.5 hours, lecture)** **V. Techniques of Protein Study (6 hours, lecture)** A. Chromatography B. Gel Electrophoresis C. Western Blot D. Fluorescence and Immunological Based Methodologies E. Sequencing **VI. Structures and Functions of DNA and RNA (3 hours, lecture)** **VII. Genomes (4.5 hours, lecture)** A. Prokaryotic B. Eukaryotic C. Viral **VIII. DNA Replication (3 hours, lecture)** **IX. Transcription and Processing (including Alternative Splicing) (4.5 hours, lecture)** **X. Translation (4.5 hours, lecture)** **XI. Control of Gene Expression (6 hours, lecture)** A. Prokaryotic B. Eukaryotic **XII. Techniques of Nucleic Acid Study (7.5 hours, lecture)** A. Recombinant DNA and Gene Cloning 1. Tools and techniques include restriction enzymes, vectors (e.g. plasmids, viruses) B. Libraries 1. Genomic 2. cDNA, 3. Chromosomal C. PCR 1. Polymerase Chain Reaction 2. RT-PCR D. Gel Electrophoresis 1. Southern and Northern Blots E. DNA Sequencing F. CRISPR-Cas9

	XIII. Application of DNA Technology and Discussion of Ethical Considerations (4.5 hours, lecture)
Total Lecture Hours:	54
Total Laboratory Hours:	0
Total Hours:	54
Primary Method of Evaluation:	1) Substantial writing assignments
Typical Assignment Using Primary Method of Evaluation:	Scenario: You are working in a laboratory where culture plates in an incubator have bacterial growth. You notice that in several plates there is also fuzzy growth that 1) looks different from the bacterial growth and 2) is surrounded by a clear area, i.e. no growth is present. In paragraph form, answer the following questions: A. What QUESTION(S) would you ask? B. What HYPOTHESIS would you propose? C. What PREDICTION, based on your HYPOTHESIS, would you make that can be tested? D. What EXPERIMENT might you propose to test your PREDICTION?
Critical Thinking Assignment 1:	Given the following research article, respond to the following questions in essay format: ARTICLE: "Small RNAs derived from the 5' end of tRNAs can inhibit protein translation in human cells" by Andrew Sobala and Gyorgy Hutvagner (RNA Biology, April 2013, 10:4, 553-563). A. What is an ABSTRACT and what does it accomplish? B. In no more than THREE sentences, summarize the key point of the paper. The limit of the number of sentences is meant to make sure you are concise. C. Pick and describe any TWO EXPERIMENTAL METHODS that were performed to carry out the work. Be sure to include in your description what each method accomplishes. Research the methods and cite your sources in your assignment. D. DATA INTERPRETATION: Evaluate Figure 1. Break the analysis down. Start with part A, then proceed with part B. Summarize what each part (A, B) of the figure suggests/demonstrates.
Critical Thinking Assignment 2:	Given the following review article, respond to the following questions in essay format: ARTICLE: "CRISPR-Cas9: A promising tool for gene editing on induced pluripotent stem cells" by Eun Ji Kim, Ki Ho Kang, and Ji Hyeon Ju (Korean Journal of Internal Medicine, 2017, 32:42-61). A. Describe the mechanism underlying CRISPR-Cas9 function. B. CRISPR-Cas9 utility is focused on genetic mutation correction. Provide two additional examples of how the technology can be used. C. Ethical concerns have been raised about the technology. What is your opinion regarding which human traits should be targeted for editing? Should there only be therapeutic considerations? Should nontherapeutic enhancements be a consideration?
Other Evaluation Methods:	Class Performance, Completion, Essay Exams, Matching Items, Multiple Choice, Other Exams, Quizzes, Term or Other Papers, True/False

Instructional Methods:	Discussion, Lecture, Multimedia presentations
If other:	
Work Outside of Class:	Answer questions, Required reading, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Textbooks:	Gerald Karp. Cell and Molecular Biology: Concepts and Experiments. 8th ed. John Wiley and Sons, Inc, 2016.
Alternative Textbooks:	
Required Supplementary Readings:	Scientific articles (research or review) and articles in science magazines and newspapers (secondary sources) as the instructor deems relevant for the subject matter presented in the lecture.
Other Required Materials:	
Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Biology-110 or Biology-110H AND Biology-120 or Biology-120H AND Chemistry-7A
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	**Compare and contrast DNA replication in eukaryotes and prokaryotes.** Bio 110- Describe the structure of DNA and its replication process. Bio 110H Discuss initiation, elongation, and termination of transcription and translation. **Provide an integrated overview and explain the importance of the flow of information from DNA to RNA to protein.** Bio 110- Explain in detail the processes of transcription and translation in cells. Bio 110H- Explain in detail the processes of transcription and translation in cells. **Compare and contrast the structures and functions of DNA and RNA.** Bio 120- Identify and describe animal structures and relate them to functions. Bio 120H- Identify and describe animal structures and relate them to functions. **Describe the basic building block, the amino acid, of proteins.** Chem 7A- For all major classes of organic compounds, the student will identify the functional group(s) and class to which a specific compound belongs and formulate specific examples for a given class. Chem 7A- For any given organic compound, the student will describe and illustrate the structure and bonding by sketching and labeling the molecular geometries within the molecule.
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	

Requisite course:	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	J. Oyama, L. Scharlin, R. Wishard
Date:	10/01/1997
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Karla Villatoro
Date:	11/12/2021
Last Board Approval Date:	01/18/2022