Course Acronym:	BIOL
Course Number:	110
Descriptive Title:	Cell and Molecular Biology
Division:	Natural Sciences
Department:	Biology
Course Disciplines:	Biological Sciences
Catalog Description:	This course offers a detailed study of eukaryotic cell anatomy, metabolism, and division, including the study of Mendelian genetics and the molecular genetics of eukaryotes. Prokaryotic cellular structure (eubacteria and archaea), microbial genetics, and viruses are also studied. The scientific method is discussed in the lecture component and students implement elements of the process in various laboratory exercises. This course is one of three courses in the biology series designed for biology majors, including those students planning to pursue a career in medicine, dentistry, or other life sciences.
Prerequisite:	Chemistry 4 or Chemistry 4H with a minimum grade of C or equivalent
Co-requisite:	
Recommended Preparation:	eligibility for English 1A
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	6
Outside Study Hours:	6
Total Course Hours:	162
Course Units:	5
Grading Method:	Letter Grade Only
Credit Status:	Credit Degree Applicable
Transfer CSU:	Yes
Effective Date:	1/22/2007
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, Area B3 - Physical Universe and its Life Forms: Laborator Activity
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 Tools** The student will be able to use the compound and dissecting microscope to observe cells and microorganisms. **SLO #3 Content Knowledge (Mitosis)** The student will be able to describe key activities in cell replication.
Course Objectives:	1. Identify the characteristics of living things and distinguish between organisms classified within the six kingdoms of living things. 2. Apply the principles of the scientific method to experimental cases. 3. Distinguish between the major types of biologically significant polymers. 4. Recognize and provide examples of the classes of amino acids and various types of polysaccharides and lipids. 5. Relate cellular structures with their functions. 6. Describe membrane structure and the various modes of transport across the membrane. 7. Utilize a compound light microscope. 8. Estimate the size of cells viewed with the compound microscope. 9. Identify the various mechanisms of cell signaling. 10. Recognize the phases of mitosis using the compound microscope. 11. Compare and contrast the processes of mitosis and meiosis. 12. Apply Mendel's Model of Heredity to predict outcomes of genetic crosses. 13. Describe the structure of DNA and its replication process. 14. Explain in detail the processes of transcription and translation in cells. 15. Utilize restriction enzymes and gel electrophoresis. 16. Evaluate the suitability of gel electrophoresis for DNA and protein separation. 17. Compose a laboratory report with the following elements (or variations thereof): Title, Abstract, Introduction, Materials and Methods, Results, Discussion, and References. 18. Identify genetic abnormalities caused by nondisjunction and gene mutation. 19. Describe mechanisms for controlling gene expression in prokaryotic and eukaryotic cells. 20. Demonstrate aseptic technique, the Gram stain, and endospore staining procedures. 21. Compare and contrast the lytic and lysogenic cycles of viruses. 22. Describe the characteristics of significant bacterial groups. 23. Explain the effects that prokaryotes have on the environment. 24. Explain the role of enzymes in cellular metabolism. 25. Describe catabolic (glycolysis and cellular respiration) and anabolic (photosynthesis) pathways and relate them to organismal function and bioenergetics.

Major Topics:	**A minimum of 80% of lab activities are hands-on experiences.** **I. Introduction (2 hours, lecture)** 1. Characteristics of Life 2. Scientific Method **II. Biochemistry (4 hours, lecture)** 1. Biologically Significant Carbon-Based Polymers **III. Cytology (4 hours, lecture)** 1. Cell Theory 2. Eukaryotic Cell Anatomy **IV. Membranes and Transport (4 hours, lecture)** 1. Classes of Membrane Proteins 2. Passive Transport 3. Active Transport **V. Cell Signaling (4 hours, lecture)** 1. Ligands 2. Signal Transduction 3. Receptor Proteins **VI. Cell Metabolism (8 hours, lecture)** 1. Energy 2. Cellular Respiration 3. Photosynthesis **VII. Cell Division (4 hours, lecture)** 1. Mitosis 2. Meiosis **VIII. Mendelian Genetics (7 hours, lecture)** 1. Monohybrid and Dihybrid Crosses 2. Linkage and Epistasis 3. Multiple Allele and Sex-Linked Inheritance 4. Human Genetic Disorders **IX. Molecular Genetics (10 hours, lecture)** 1. DNA Structure and Replication 2. Gene Mutation 3. Gene Expression 1. Transcription

2. Translation
4. Control of Gene Expression
    1. Bacterial Operons
    2. Transcription Factors
5. Gene Technology

X. Viruses (2 hours, lecture)

1. Lytic and Lysogenic Cycles
2. Viral Diseases

XI. Bacteria (5 hours, lecture)

1. Prokaryotic Anatomy and Physiology
2. Bacterial Diseases
3. Significant Bacterial Groups

XII. Introduction to Laboratory Procedure (3 hours, lab)

The students will review:

1. Safety
2. Use of Statistics
3. The students will practice lab safety and employ statistical analyses in lab work.

XIII. Use of the Microscope (3 hours, lab)

The students will employ:

1. Field of View Assessment
2. Total Magnification Determination

XIV. Biochemical Polymers (3 hours, lab)

The students will learn about biochemical polymers by performing biochemical tests to gain an understanding of structural characteristics.

1. Carbohydrates
2. Lipids
3. Proteins
4. Nucleic Acids

XV. Cell Structure (7 hours, lab)

The students will microscopically evaluate eukaryotic and prokaryotic cellular structures.

1. Eukaryotic
    1. Plant
    2. Animal
    3. Protist
2. Prokaryotic

1. Cyanobacteria

XVI. Membranes (7 hours, lab)

The students will perform various experiments to evaluate membrane structural and functional integrity.

1. Structure
2. Transport
    1. Diffusion
    2. Osmosis

XVII. Cell Metabolism (21 hours, lab)

The students will perform various hands-on activities that assess cellular metabolism.

1. Enzymes
2. Cellular Respiration
3. Photosynthesis

XVIII. Cell Division (7 hours, lab)

The students will microscopically assess mitotic and meiotic stages to gain an understanding of cellular division processes.

1. Mitosis
2. Meiosis

XIX. Genetics (7 hours, lab)

The students will perform activities focused on Mendelian crosses, hypothetical blood typing, and pedigree analysis to gain an understanding of fundamental genetic principles.

1. Mendelian Crosses
2. Blood Typing
3. Pedigree Analysis

XX. Gene Technology (30 hours, lab)

The students will perform activities to gain a fundamental understanding of molecular biological processes. All below are hands-on activities.

1. Equipment
2. Methodology
    1. Agarose Gel Electrophoresis
    2. Polyacrylamide Gel Electrophoresis
3. Polymerase Chain Reaction (PCR)
4. Restriction Enzymes (Endonucleases)
5. DNA and Protein Separation and Analyses

	XXI. Transformation (10 hours, lab)
	
	The students will perform a transformation experiment that employs the control of gene expression to gain an understanding of molecular biological processes and phenotypic change.
	
	1. Bacterial Culture
	  1. Bacteria
	  2. Medium
	2. Plasmid Utilization
	3. Control of Gene Expression
	
	XXII. Bacteria (10 hours, lab)
	
	The students will perform activities to gain an understanding of prokaryotic structural and functional characteristics. All below are hand-on activities (e.g. inoculating media, propagating bacteria, preparing and staining specimen-based slides, and analyzing results).
	
	1. Morphological Characteristics
	  1. Culture Appearance
	  2. Gram and Endospore Stains (including microscopic assessments)
	2. Motility Assessment
	3. Physiological Requirements
	4. Antibiotic Sensitivity
	5. Mutagenesis

Total Lecture Hours:	54
Total Laboratory Hours:	108
Total Hours:	162
Primary Method of Evaluation:	1) Substantial writing assignments
Typical Assignment Using Primary Method of Evaluation:	Write a formal laboratory report for the Gel Electrophoresis Separation of DNA lab exercise (or another exercise of the instructor's preference) and include an abstract. The introduction should be researched and written with references cited. The procedure that was followed and the results of the exercise, using appropriate tables and graphs, should be included. Conclude the paper by evaluating the results and listing the references cited (a minimum of three).
Critical Thinking Assignment 1:	Using agglutination test results with simulated blood, determine the blood types of two infants and link each infant with its probable parents, whose blood types are known.
Critical Thinking Assignment 2:	Hypothesize and predict the degree of membrane damage to beet cells from temperature stress and organic solvents, and test your predictions using relative color intensity of damaged cells. Write a short report detailing your results and conclusions.
Other Evaluation Methods:	Completion, Essay Exams, Homework Problems, Laboratory Reports, Matching Items, Multiple Choice, Objective Exam, Other Exams, Term or Other Papers, True/False, Written Homework
Instructional Methods:	Demonstration, Lab, Lecture, Multimedia Presentations
If other:	

Work Outside of Class:	Answer questions, Problem solving activity, Required reading, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Textbooks:	Peter J. Russell; Paul E. Hertz; Beverly McMillan, **Biology: The Dynamic Science**, 5th ed. 2021 Darrell Vodopich and Randy Moore, **Biology Laboratory Manual**, 12th Edition 2020
Alternative Textbooks:	Urry et al. Campbell Biology, 11th ed. Pearson, 2017.
Required Supplementary Readings:	Scientific articles (primary sources) and articles in science magazines and newspapers (secondary sources) as the instructor deems relevant for the subject matter presented in the lecture and/or the laboratory.
Other Required Materials:	Laboratory notebook and colored pencils are the other required materials.
Requisite:	Prerequisite
Category:	Standard
Requisite course(s): List both prerequisites and corequisites in this box.	Chemistry-4 or Chem-4H
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Use the language of general chemistry (vocabulary nomenclature, formulas and equations) to describe chemical systems and changes (physical and chemical) they undergo.** CHEM 4 - Utilize the language of chemistry, including vocabulary, symbols, formulas, and equations. CHEM 4H - Utilize the language of chemistry, including vocabulary, symbols, formulas, and equations. **Describe the structure of the atom in terms of the arrangement of subatomic particles and electronic configuration.** CHEM 4 - Utilize the language of chemistry, including vocabulary, symbols, formulas, and equations. CHEM 4H - Utilize the language of chemistry, including vocabulary, symbols, formulas, and equations **Distinguish between ionic and covalent bonding and write Lewis structures for molecules and polyatomic ions.** CHEM 4 - Compare and contrast ionic and covalent compounds. Evaluate bonding based on the chemical formula, and then correlate compound properties with the structure and types of bonding present. CHEM 4H - Compare and contrast ionic and covalent compounds. Evaluate bonding based on the chemical formula, and then correlate compound properties with the structure and types of bonding present.

	State the properties and definitions of acids and bases and interpret elementary acid-base equilibria. CHEM 4 - Compare and contrast physical properties, physical changes, chemical properties, and chemical changes. CHEM 4 - Predict the direction of equilibrium shift in equilibrium processes, given a change in concentration, temperature, or volume of substances involved. CHEM 4H - Compare and contrast physical properties, physical changes, chemical properties, and chemical changes. CHEM 4H - Predict the direction of equilibrium shift in equilibrium processes, given a change in concentration, temperature, or volume of substances involved.
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).	
Requisite Skill:	eligibility for English 1A
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	**Students need well-developed reading skills in order to understand and interpret information in their textbooks and writing skills to develop essays, projects, and reports.** Summarize, analyze, evaluate, and synthesize college-level texts. Write a well-reasoned, well-supported expository essay that demonstrates application of the academic writing process.
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Steve Leonelli and Teresa Palos
Date:	10/01/2006
Original Board Approval Date:	01/22/2007
Last Reviewed and/or Revised by:	Karla Villatoro
Date:	05/20/2022

Last Board Approval Date:	06/20/2022