Course Outline

2026-2027 Catalog

BIOL 41 - Cell and Molecular Biology

Catalog Description

Transfer Status: CSU/UC

Prerequisite: CHEM 1 and Intermediate Algebra or equivalent

Unit(s): 5.00

Lecture: 51.00 Contact hours/102.00 Out of class hours/153.00 Total hours/3.00 Unit(s)
Lab: 102.00 Contact hours/0.00 Out of class hours/102.00 Total hours/2.00 Unit(s)
Total: 153.00 Contact hours/102.00 Out of class hours/255.00 Total hours/5.00 Unit(s)

Course Description: This course is an introductory study of prokaryotic and eukaryotic cell structure and function as well as basic viral structure and reproduction. Attention is given to life processes within cells and to interactions between cells. Coverage includes experimental design and statistical analysis; basic biotechnology concepts and techniques; DNA structure, function, and gene expression; enzyme function; energetics; nutrient cycles in ecosystems; transport mechanisms; cytoskeletal components; cell communication (including nerve impulse conduction and signal transduction); cell reproduction; Mendelian and population genetics; cell evolution; and modern concepts of molecular biology. This course is designed for biology majors. (C-ID BIOL 190/BIOL 135S).

Objectives

Upon successful completion of this course, the student should be able to:

1. Describe key cell processes (including metabolism and cellular interactions) and explain how the chemical properties of molecules relate to these processes.
2. Compare and contrast prokaryotic cells, eukaryotic cells, viruses and prions.
3. Design and execute a simple biological experiment which includes: research of primary sources; appropriate tests with controls and appropriate blinding; analyzing data; and presenting findings as a scientific report with appropriate formatting and graphs.
4. Apply knowledge previously gained to analyze problems in cell biology previously not experienced by the student.
5. Use basic cell biology laboratory equipment and methods including: spectrophotometry, micropipetting, polymerase chain reaction, data acquisition and analysis, horizontal gel electrophoresis, gene cloning, bioinformatics, microscopy and aseptic technique.
6. Perform calculations used in laboratory work and genetics.
7. Explain concepts in biotechnology and current research.

Course Content

Topic Titles / Suggested Time Topic

Lecture

Topics	Lec Hrs
Chemistry of life. CHNOPS, lipids, nucleotides, amino acids, and carbohydrates.	10.00
Metabolism. Enzymes, respiration, photosynthesis, and fermentation.	9.00
Cell Diversity and Evolution.	2.00
Cell Cycle. Role of the cytoskeleton and enzymatic regulation in mitosis and meiosis.	3.00
DNA replication, telomeres, PCR, DNA sequencing.	3.00
Central dogma of molecular biology, transcription, translation, regulation of gene expression, post-transcriptional and post-translational modifications, mutations.	12.00
Intracellular signaling.	1.00
Movement. Role of cytoskeleton in the movement of muscles, flagella, and cilia.	2.00
Key historical events in the study of cell biology	1.00
Eukaryotic and Prokaryotic cell structure and function.	5.00
Membrane structure and transport.	2.00
Intercellular connections and signaling.	1.00
Total Hours:	**51.00**

Lab

Topics	Lab Hrs
Scientific Method	7.00
Lab Techniques, data analysis and Statistics	8.00
Testing for Macromolecues	4.00
DNA isolation and Gel Electrophoresis	5.00

Topics	Lab Hrs
Protein Quantification and Sequencing	6.00
Membranes	3.00
Aseptic technique and cell culture	5.00
Enzyme Kinetics and regulation	9.00
Respiration and Fermentation	3.00
Microscope use and measurements	4.00
Bacterial Metabolism	4.00
Staining Cell Structures	3.00
Viruses	4.00
Cell Division	3.00
Mendelian genetics and Genetic Variation	5.00
Mutations	4.00
DNA amplification, sequencing and cloning	6.00
Buffering in biological systems	3.00
Bacterial cell structures and properties	4.00
Bioinformatics and primer design	3.00
Research strategies and experimental design	6.00
Presentation of scientific research	3.00
Total Hours:	**102.00**

Methods of Instruction

A. Class Activities
B. Collaborative Group Work
C. Discussion
D. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
E. Instructor Demonstrations
F. Laboratory Experiments
G. Multimedia Presentations
H. Reading Assignments
I. Biology Majors Sequence

Methods of Evaluation

A. Exams/Tests
B. Oral Presentation
C. Projects
D. Written Assignments
E. Practical Evaluations
F. Essays and research papers
G. Group Participation

Examples of Assignments

Reading Assignments

1. Read the chapter on cell structure in your textbook and organize the presented information in a table. The table should include: 1) each cell structure discussed; 2) the biochemical composition of each structure; 3) the function of each structure; 4) the location of each structure in the cell.
2. Read the exercise in the lab manual on membrane properties and create a flowchart that summarizes what you will do in lab. The flowchart should be detailed enough such that you would only need it, and not your lab manual, in lab to be able to perform the experiment.

Writing Assignments

1. Choose a primary research article that will provide background for your group research projects. Read the article and write a 3 page summary that includes the following: 1) a statement describing the question(s) being asked by the researchers; 2) a summary of the background information provided that puts this question in context, i.e. why is it important that this question be answered?; 3) a description of the experimental design(s); 4) a summary of the findings and how this advances our understanding of the topic at hand.
2. For the Chromosomal Preparation from Bacterial Cells laboratory exercise, make an entry in your lab notebook that includes the following: 1) a statement of purpose for the lab; 2) a flowchart or diagram that describes the procedures to be followed for the lab exercise; 3) a results section in which you record your data in tabular form using proper scientific formatting; and 4) a discussion section in which your summarize your findings and describe what they mean.

Out-of-Class Assignments

1. In groups of no more than 4, design a research project to be conducted during the semester and write a 5 page project proposal for the project. The proposal should include: 1) your research question(s) clearly stated; 2) an explanation of why this question is important to study; 3) the null hypothesis, and the alternative hypothesis; 4) your experimental outline, and an explanation of how this answers your questions; 5) what variables you will be measuring and how often you will measure them. Include dependent, and independent variables, control and test group(s), and Indicate how many replicates you will perform; and 6) a timeline of your proposed experiment, indicating what will be done when, to complete the project by the end of the semester.
2. In groups of 2, find a current (within 6 months) news topic relating to cellular and molecular biology. Prepare an overhead presentation of 5 slides that summarizes the research findings and describe how this relates to material you have learned in this class.

Recommended Materials of Instruction

Raven, P., et. al. (2020). Biology. *McGraw Hill, 12th.* 9781260169614.

Urry, Cain, Wasserman, Minorsky and Orr. (2021). Campbell Biology. *Pearson, 12th.* 9780135988046.

White, A. et al. (2021). BIOL 41 Laboratory Manual. *Butte college press, current.* in house production.

Other Learning Materials

Other supportive material to be provided by instructor or library or course web site.

Scientific Calculator

goggles and lab coat

Minimum Qualifications

Biological Sciences (Masters Required)

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