BUTTE COLLEGE
COURSE OUTLINE

I. **CATALOG DESCRIPTION**

BIOL 13 - Cell and Molecular Biology **5 Unit(s)**

Prerequisite(s): CHEM 1 and Math Level V
Recommended Prep: BIOL 11 or BIOL 12 and Reading Level IV; English Level IV
Transfer Status: CSU/UC
51 hours Lecture
102 hours Lab

This course is an introductory study of procaryotic and eucaryotic 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. Offered Spring only. (C-ID BIOL 190).

II. **OBJECTIVES**

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

A. Describe key cell processes (including metabolism and cellular interactions) and explain how the chemical properties of molecules relate to these processes.
B. Compare and Contrast procaryotic cells, eucaryotic cells, viruses and prions.
C. 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.
D. Apply knowledge previously gained to analyze problems in cell biology previously not experienced by the student.
E. Use basic cell biology laboratory equipment and methods including: a spectrophotometer, micropipettes, thermal cycler, computer-based data acquisition equipment; vertical and horizontal gel electrophoresis, column chromatography, microscopy and aseptic technique.
F. Perform calculations used in laboratory work and genetics.
G. Explain concepts in biotechnology and current research.

III. **COURSE CONTENT**

A. **Unit Titles/Suggested Time Schedule**

Lecture

Topics	Hours
1. Chemistry of life. CHNOPS, lipids, nucleotides, amino acids, and carbohydrates.	8.00
2. Metabolism. Enzymes, respiration, photosynthesis, fermentation, and nutrient cycles.	9.00
3. Cell Diversity and Evolution.	2.00
4. Viruses, viral repliation, viroids, prions.	2.00
5. Cell Cycle. Role of the cytoskeleton and enzymatic regulationin mitosis and meiosis.	2.00

6. Mendelian genetics and gene mapping.	3.00
7. DNA replication, telomeres, PCR, DNA sequencing.	3.00
8. Protein Synthesis. Reading the genetic code, regulation of protein synthesis, post-transcriptional and post-translational modifications, mutations.	9.00
9. Biotechnology. Genetic Engineering, Microarrays, etc.	4.00
10. Nerve conduction. Membrane structure and transport.	2.00
11. Immune system. Intercellular signaling, role of antibodies and cell types.	2.00
12. Intracellular signaling.	2.00
13. Movement. Role of cytoskeleton in the movement of muscles, flagella, and cilia.	2.00
14. Key historical events in the study of cell biology	1.00
Total Hours	51.00

Lab

Topics	Hours
1. Scientific Method	5.00
2. Lab Techniques and Statistics	5.00
3. Testing for Macromolecues	4.00
4. DNA isolation and Gel Electrophoresis	5.00
5. Protein Quantification and Sequencing	6.00
6. Membranes	3.00
7. Aseptic technique	3.00
8. Enzyme Kinetics	6.00
9. Fermentation	3.00
10. Photosynthesis	3.00
11. Nitrogen Cycle	4.00
12. Microscope use and measurements	3.00
13. Bacterial Metabolism	4.00
14. Staining Cell Structures	3.00
15. Viruses	3.00
16. Cell Division	3.00
17. Genetic Variation and Natural Selection	4.00
18. Mutations	3.00
19. DNA Sequencing and Fingerprinting	6.00
20. Plasmid Mapping	3.00
21. Bacterial Transformation	3.00
22. Plant Tissue Culture	3.00
23. Protein Isolation and Vertical Gels	5.00
24. Movement	4.00
25. Neurons	4.00
26. ELISA and Epidemiology	4.00
Total Hours	102.00

IV. **METHODS OF INSTRUCTION**

A. Lecture
B. Instructor Demonstrations
C. Collaborative Group Work
D. Discussion
E. Multimedia Presentations
F. Laboratory Experiments
G. Text and Outside Reading (including primary research)
H. Independent Research Project
I. Homework Exercises, Practice Problems and Review Questions
J. Students are required to complete two hours of outside-of-class homework for each course unit

V. **METHODS OF EVALUATION**

A. Exams/Tests
B. Quizzes
C. Research Projects
D. Oral Presentation
E. Homework
F. Lab Projects
G. Practical Evaluations
H. Essays and research papers

VI. **EXAMPLES OF ASSIGNMENTS**

A. 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.

B. Writing Assignments
    1. 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.
    2. 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.

C. Out-of-Class Assignments
    1. 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.

2. 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 question; 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.

VII. **RECOMMENDED MATERIALS OF INSTRUCTION**

Textbooks:

A. Raven, P., et. al. Biology. 10th Edition. McGraw Hill, 2014.
B. White, A. Biology 13 Unit Pack. Butte College Press, 2015.

Materials Other Than Textbooks:

A. Other supportive material to be provided by instructor or library or course web site.
B. Scientific Calculator
C. goggles and lab coat

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