

College of San Mateo
Official Course Outline

1. **COURSE ID:** BIOL 230 **TITLE:** Introductory Cell Biology **C-ID:** BIOL 190; BIOL 210+220+230 = BIOL 135S
Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 48.0-54.0 Lab hours; and 96.0-108.0 Homework hours
Method of Grading: Letter Grade Only
Prerequisite: CHEM 210, and either BIOL 210, or BIOL 220 or BIOL 215 (Skyline) or BIOL 225 (Canada).
Recommended Preparation:
Eligibility for ENGL 100 or ENGL 105

2. **COURSE DESIGNATION:**
Degree Credit
Transfer credit: CSU; UC
AA/AS Degree Requirements:
CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
CSU GE:
CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B2 - Life Science
CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
IGETC:
IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: B: Biological Science
IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory

3. **COURSE DESCRIPTIONS:**
Catalog Description:
Evaluation and analysis of the living cell and its components. Examines cell structures and metabolism as they relate to cell function and reproduction. (Recommended for all Biology majors.) . One or more field trips may be required. Extra supplies may be required.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
Upon successful completion of this course, a student will meet the following outcomes:
 1. Describe and relate the origin of life and subsequent evolution of organelle structure and function in prokaryotic and eukaryotic cells, including landmark experiments.
 2. Identify and describe structure and major functions of cellular organic molecules.
 3. Explain mechanisms of cellular metabolic processes of respiration, photosynthesis and eukaryotic cell cycle.
 4. Distinguish and compare biochemistry, synthesis of nucleic acids and proteins, including major experimental techniques.
 5. Explain and apply principles of classical/Mendelian Genetics to problems in genetics or biotechnology.
 6. Describe elements of prokaryotic and eukaryotic gene regulation and signal transduction.
 7. Demonstrate basic laboratory skills for objective investigation of cell biology phenomena and a scientific approach to investigating cells.
 8. Communicate explanations of cell biology phenomena in writing.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
Upon successful completion of this course, a student will be able to:
 1. Describe and relate the origin of life and subsequent evolution of organelle structure and function in prokaryotic and eukaryotic cells, including landmark experiments.
 2. Identify and describe structure and major functions of cellular organic molecules.
 3. Explain mechanisms of cellular metabolic processes of respiration, photosynthesis and eukaryotic cell cycle.
 4. Distinguish and compare biochemistry, synthesis of nucleic acids and proteins, including major experimental techniques.
 5. Explain and apply principles of classical/Mendelian Genetics to problems in genetics or biotechnology.
 6. Describe elements of prokaryotic and eukaryotic gene regulation and signal transduction.
 7. Demonstrate basic laboratory skills for objective investigation of cell biology phenomena and a scientific approach to investigating cells.

8. Communicate explanations of cell biology phenomena in writing.

6. COURSE CONTENT:

Lecture Content:

Course Content-lecture topics

1. Origin of Life; evolution of organelle structure and function in prokaryotic and eukaryotic cells; Eukaryotic Cell Organelles: structure, functions (SLO #1)
2. Cell division, cell cycle control; Cell fractionation and analysis (SLO #1)
3. Water and organic molecules in cells; complex structure and function of proteins (SLO #2)
4. Principles of Metabolism: endergonic and exergonic reactions, activation energy, energy coupling, enzyme catalysis (SLO #3)
5. Membranes: phospholipid bilayer, role of proteins in transport, communication, energy requirements for transport (SLO #1, 2, 3)
6. Cellular Respiration: overall energy considerations, oxidation-reduction cycles, locations, glycolysis, fermentation, citric acid cycle, electron transport, role of mitochondrial membrane, chemiosmotic mechanism of ATP synthesis; allosteric regulation of enzymes in metabolism (SLO #3)
7. Photosynthesis: overall energy considerations, oxidation-reduction cycles, role of chlorophyll, photosystems, thylakoid membranes, photophosphorylation mechanism (SLO #3)
8. DNA Structure, Replication: evidence for semiconservative mechanism; process at chromosomal and biochemical levels (SLO #4)
9. RNA structure and synthesis; Molecular (nucleic acid) hybridization (SLO #4)
10. Protein synthesis: genetic code, components, steps; Mutation causes and consequences and relation to classical/Mendelian genetics (SLO #4, 5)
11. DNA Technology: restriction enzymes, cloning, analysis of DNA by hybridization, applications (SLO #4)
12. Prokaryotic Gene Regulation: coupled transcription, translation; operon regulation (SLO #6)
13. Eukaryotic Gene Structure, Regulation: introns, exons, RNA processing, steroid hormone action, chromosome packaging; comparison of prokaryotic and eukaryotic regulation; antibody genes (SLO #6)
14. Cell Communication: hormones, target cells, G-protein-linked receptors, cyclic AMP, and allosteric activation of protein kinase (SLO #6)

Lab Content:

Course content-laboratory topics

1. Pipets, dilutions, metric units (SLO #7, 8)
2. Molecular models (SLO #7, 8)
3. Protein extraction, quantification and analysis by electrophoresis (SLO #2, 7, 8)
4. Science and Cells: Designing Experiments to Test Hypotheses; review use of microscope (SLO #7, 8)
5. Bacterial Growth, selective plating (SLO #7, 8)
6. Enzyme Activity (SLO #2, 7, 8)
7. Modeling and molecular explanations of classical/Mendelian genetics (SLO #2, 5)
8. DNA extraction and analysis: mini-plasmid preparation, restriction enzyme digests, sizing DNA by electrophoresis (SLO #2, 7, 8)
9. Modeling principles of complementary base pairing and information flow: replication, transcription, DNA sequencing; Molecular basis for Mendelian inheritance (SLO #4, 7, 8)
10. Student models of cell biology processes or structures; presentations on cell biology topics (SLO #7, 8)

7. REPRESENTATIVE METHODS OF INSTRUCTION:

Typical methods of instruction may include:

- A. Lecture
- B. Lab
- C. Activity
- D. Directed Study
- E. Discussion
- F. Experiments
- G. Guest Speakers
- H. Observation and Demonstration

8. REPRESENTATIVE ASSIGNMENTS

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

Written laboratory assignments clearly record each exercise: theoretical questions, experimental design, procedures, observations, summary and interpretation of results. Assignments evaluate how well results compare to expectations, relate experiments and results to principles studied in lecture.

Independent research into selected topics, resulting in poster, model and oral presentations demonstrating identification and evaluation of main concepts of topic.

Reading Assignments:

Reading in textbook to restate lecture and laboratory concepts, illustrate points of lecture, define terms, and provide examples.

Reading journal and website articles assigned to further research lab and lecture concepts.

Other Outside Assignments:

- Preparing 4 individual presentations of answers to assigned Study Questions (counted as part of lab attendance);
- Preparing 2 individual presentations of amino acid interactions in proteins with 3 x 5 card amino acid sets made in Lab 2 (counted as part of lab assignment grade);
- Designing and constructing a model of basic lecture concept with one other student (counted as part of lab assignment grade).

9. REPRESENTATIVE METHODS OF EVALUATION

Representative methods of evaluation may include:

- A. Class Participation
- B. Class Work
- C. Exams/Tests
- D. Homework
- E. Lab Activities
- F. Oral Presentation
- G. Projects
- H. Quizzes
- I. Simulation
- J. Written examination
- K. Midterm and Final exams assess student's ability to communicate SLOs 1-6, using SLO 7. Laboratory assignments assess student's methods, careful recording of observations, results, clear evaluation of conclusions, SLOs 6 and 7 and reinforcement of SLOs 1-5. Oral and poster or model presentations reveal students' ability to identify and evaluate main concepts of selected topics.

10. REPRESENTATIVE TEXT(S):

Possible textbooks include:

- A. Alberts et al. *ESSENTIAL CELL BIOLOGY*, 5th ed. Garland Science Publishers, 2020
- B. Hardin et al. *BECKER'S WORLD OF THE CELL*, 8th ed. Benjamin Cummings, 2012

Possible manuals include:

- A. Diamond. Laboratory exercises are individually prepared and uploaded to Canvas site for the course, Bio 230 Canvas site at College of San Mateo, 08-15-2022

Origination Date: November 2021

Curriculum Committee Approval Date: November 2021

Effective Term: Fall 2022

Course Originator: Kathleen Diamond