**Las Positas College**
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**Course Outline for BIO 1C**

**CELL AND MOLECULAR BIOLOGY**

**Effective: Fall 2016**

I. CATALOG DESCRIPTION:
BIO 1C — CELL AND MOLECULAR BIOLOGY — 5.00 units

Principles of cell and molecular biology. Includes biochemistry, cell structure and function, cell homeostasis, cell metabolism, cell reproduction, cell communication, genetics, molecular biology, biotechnology, and evolution. Emphasis on scientific inquiry and experimental design. (Note: BIOL 1.)

3.00 Units Lecture 2.00 Units Lab

**Prerequisite**
BIO 1A - General Botany
with a minimum grade of C
or

BIO 1B - General Zoology
with a minimum grade of C

MATH 55 - Intermediate Algebra for STEM

- Eligibility for ENG 1A -

CHEM 1A - General College Chemistry I

**Grading Methods:**
Letter Grade

**Discipline:**

| | MIN |
|---|---|
| **Lecture Hours:** | 54.00 |
| **Lab Hours:** | 108.00 |
| **Total Hours:** | 162.00 |

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

**Before entering the course a student should be able to:**

A. BIO1A
1. Recognize the evolutionary relationships among the major groups of plants, fungi, and photosynthetic protistan taxa
2. Make detailed and productive observations of plant structures, in both field and laboratory, and interpret their observations using principles learned in the course
3. Describe and contrast life cycles within and among major plant, fungal, and photosynthetic protistan taxa
4. Describe plant hormones and their uses in industrial agriculture.
5. Apply physiological principles learned in the course to the growth and maintenance of plants
6. Use a compound or dissecting microscope to identify organisms, tissues, and cell types.

B. BIO1B
1. Compare and contrast characteristics of major animal taxa
2. Explain, construct, and interpret phylogenies
3. Summarize the phylogenetic relationships among animal taxa
4. Explain diffusion and osmosis; explain and give examples of osmoregulation in different organisms;
5. Compare and contrast anatomy and physiology among different taxa, including digestive, respiratory, excretory systems, circulatory, muscular, nervous, and reroductive systems;
6. Explain mechanisms of evolutionary change
7. Explain examples of animal behavior and relate behaviors to evolutionary significance
8. Properly use and care for compound and dissecting microscopes for microscopic examination of biological structures
9. Apply scientific methodology and critical thinking through experimentation and experiences

C. MATH55
D. -Eligibility for ENG 1A
E. CHEM1A

1. Write short explanations describing various chemical phenomena studied;
2. Write balanced chemical equations including net ionic equations;
3. Write balanced chemical equations for oxidation-reduction reactions;
4. Use standard nomenclature and notation;
5. Calculate enthalpies of reaction using calorimetry, Hess's Law, heats of formation, and bond energies;
6. Describe bonding in compounds and ions;
7. Describe the nature of solids, liquids, gases and phase changes;
8. Define concentrations of solutions in terms of molarity, molality, normality, percent composition, and ppm;
9. Solve solution stoichiometry problems;
10. Determine the extent of molecular reactions through the study of equilibrium;
11. Apply Le Châtelier's principle to equilibria;
12. Collect and analyze scientific data, using statistical and graphical methods;
13. Perform volumetric analyses;
14. Use a visible spectrophotometer;
15. Acquire and analyze data with a computer and appropriate software.

IV. MEASURABLE OBJECTIVES:

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

A. Identify and explain structure and function of biologically important molecules;
B. Describe cell membrane structure, compare mechanisms of membrane transport, and discuss types of cell junctions;
C. Summarize enzyme structure and relate to function;
D. Identify and explain structure and function of cells and cell organelles;
E. Compare and contrast cellular metabolic pathways
F. Compare and contrast cell reproduction processes, including the cell cycle, mitosis, and meiosis;
G. Compare and contrast cell communication processes, including cell signaling and signal transduction
H. Explain how DNA replicates and transmits genetic information within organisms.
I. Interpret genetic crosses and patterns of inheritance, explain examples of non-Mendelian inheritance, and solve genetics problems;
J. Describe chromosome structure, explain the patterns of inheritance of sex chromosomes, and compare features of the prokaryotic and eukaryotic genomes;
K. Explain examples of how gene expression is regulated.
L. Apply classical and molecular genetics to solve problems in genetics or biotechnology
M. Describe the molecular basis of the action potential, muscle contraction, and antibody action;
N. Explain and apply the major tools and techniques used in biotechnology
O. Relate evolutionary processes to the origin and evolution of cellular life
P. Discuss microevolution, and explain and discuss the evidence for Darwin's Theory of Natural Selection
Q. Discuss macroevolution, compare species concepts, and explain mechanisms for speciation.
R. Perform, document, explain, and interpret a variety of biochemistry, cell, and molecular techniques and experiments.
S. Apply methods of scientific inquiry and experimental design to the study of biological concepts
T. Acquire, read, evaluate, apply, and cite scientific literature
U. Practice scientific writing.

V. CONTENT:

A. Lecture
1. Cellular chemistry and biological molecules
2. Structure and function of cells and organelles
3. Structure and function of cell membranes; action potential
4. Cellular transport across membranes
5. Structure and function of enzymes
6. Cell Reproduction and cell cycle regulation
7. Cellular metabolism (cellular respiration, fermentation, photosynthesis)
8. Cell communication
9. Classical/Mendelian and non-Mendelian genetics
10. Molecular genetics
11. DNA structure and function
12. Gene structure
13. Gene expression and regulation of gene expression
14. Biotechnology
15. Origin and evolution of life and molecules
16. Natural selection
17. Microevolution and population genetics
18. Macroevolution and speciation
19. Scientific inquiry

B. Laboratory
1. Microscopy
2. Spectroscopy
3. Biologically important molecules
4. Cell structure
5. Membrane transport
6. Enzyme function
7. Cell reproduction
8. Genetics
9. DNA isolation
10. Gel electrophoresis (DNA and protein)
11. Chromosomes
12. Transformation
13. PCR
14. Population Genetics

VI. METHODS OF INSTRUCTION:

A. Articles from scientific literature
B. **Discussion** -
D. **Lecture** -
E. Audio-visual presentations
F. Laboratory experiments
G. **Field Trips** -
H. **Projects** -
I. Laboratory exercises

VII. TYPICAL ASSIGNMENTS:

A. Prepare samples for microscopy, including using various stains for visualization.
B. Perform extraction of DNA.
C. Prepare and run agarose gel electrophoresis.
D. Write a scientific report on an experiment or independent research project, using proper scientific report format.

VIII. EVALUATION:

A. **Methods**

1. Other:
    a. Lecture quizzes and/or midterms, and final exam
    b. Laboratory quizzes, assignments, and/or reports
    c. Laboratory practical exams
    d. Field trip assignments
    e. Independent Research Project

B. **Frequency**

1. Quizzes, as appropriate; at least 1 midterm; and 1 final exam
2. Laboratory quizzes, assignments, and/or reports, corresponding to each lab
3. At least one Laboratory practical examination
4. 1 or more field trip assignments, if applicable
5. 1 Independent research project

IX. TYPICAL TEXTS:

1. Campbell, Neil A., and Jane B. Reece *Campbell Biology*. 9th ed., Benjamin Cummings, 2014.
2. *Biology: The Dynamic Science.* 2nd ed., Cengage, 2012.
3. Freeman, Scott, and Kim Quillin. *Biological Science.* 5th ed., Benjamin Cummings, 2013.
4. Ho, Nan. Biology 1: Cell Biology Custom Lab Manual. Pearson Custom Publishing , 2014.
5. Custom lab manuals and handouts

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. Laboratory manual and/or custom laboratory packages Personal Protective Equipment (PPE)