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Course Outline for BIO 1C
CELL AND MOLECULAR BIOLOGY
Effective: Spring 2018

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: Formerly 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

CHEM 1A - General College Chemistry I

- Eligibility for ENG 1A -

Grading Methods:

Letter Grade

Discipline:

- Biological Sciences

	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. Summarize evolutionary relationships using phylogenetic trees and build phylogenetic trees using morphological or molecular data.
3. Describe and contrast life cycles within and among major plant, fungal, and photosynthetic protistan taxa
4. Explain diffusion, osmosis, osmoregulation and water balance at the cellular and organismal level.
5. Acquire, use, and cite scientific literature for scientific writing
6. Conduct a biology research project or experiment, and clearly convey the results using correct scientific format.
7. Apply scientific methodology and reasoning through experimentation and experiences
8. Use a compound or dissecting microscope to identify organisms, tissues, and cell types.
9. Perform laboratory experiments in an efficient, safe, and purposeful manner.

B. BIO1B

1. Explain, construct, and interpret phylogenies
2. Explain diffusion and osmosis; explain and give examples of osmoregulation in different organisms;
3. Distinguish among and explain the structure and function of the different types of animal tissues;
4. Compare and contrast asexual and sexual reproduction
5. Discuss and compare developmental patterns among animal taxa and heterotrophic unicellular eukaryotes; provide examples of how development of structures is related to their evolutionary history
6. Describe origin and importance of multicellularity
7. Explain mechanisms of evolutionary change
8. Explain the evidence for evolution

9. Properly use and care for compound and dissecting microscopes for microscopic examination of biological structures
 10. Apply scientific methodology and critical thinking through experimentation and experiences
 11. Perform laboratory experiments in an efficient, safe, and purposeful manner
 12. Keep a detailed, well-organized, and comprehensive lab notebook
 13. Demonstrate proficiency with dissection and proper and safe care, use, and choice of dissection tools, including microscopic examination;
 14. Acquire, use, and properly cite scientific literature appropriately in scientific writing.
 15. Conduct a biology research project or experiment, and clearly convey the results using correct scientific format.
- C. MATH55
- D. CHEM1A
1. Solve complex problems involving the concepts listed under course content;
 2. Write short explanations describing various chemical phenomena studied;
 3. Write balanced chemical equations including net ionic equations;
 4. Write balanced chemical equations for oxidation-reduction reactions;
 5. Describe the different models of the atom;
 6. Use standard nomenclature and notation;
 7. Calculate enthalpies of reaction using calorimetry, Hess's Law, heats of formation, and bond energies;
 8. Describe hybridization, geometry and polarity for molecules and polyatomic ions;
 9. Describe bonding in compounds and ions;
 10. Describe simple molecular orbitals of homonuclear systems;
 11. Describe the nature of solids, liquids, gases and phase changes;
 12. Describe metallic bonding and semiconductors;
 13. Describe network covalent bonding;
 14. Define concentrations of solutions in terms of molarity, molality, normality, percent composition, and ppm;
 15. Describe colligative properties of solutions;
 16. Solve solution stoichiometry problems;
 17. Determine the extent of molecular reactions through the study of equilibrium;
 18. Apply Le Châtelier's principle to equilibria;
 19. Utilize library and Internet resources in Chemistry;
 20. Collect and analyze scientific data, using statistical and graphical methods;
 21. Perform volumetric analyses;
 22. Use a visible spectrophotometer;
 23. Acquire and analyze data with a computer and appropriate software.
- E. -Eligibility for ENG 1A
1. Use strategies to assess a text's difficulty, purpose, and main idea prior to the act of reading
 2. Annotate a text during the act of reading
 3. Employ strategies that enable a critical evaluation of a text
 4. Respond critically to a text through class discussions and writing
 5. Use concepts of paragraph and essay structure and development to analyze his/her own and others' essays
 6. Write effective summaries of texts that avoid wording and sentence structure of the original
 7. Respond to texts drawing on personal experience and other texts
 8. Organize coherent essays around a central idea or a position
 9. Apply structural elements in writing that are appropriate to the audience and purpose
 10. Provide appropriate and accurate evidence to support positions and conclusions
 11. Produce written work that reflects academic integrity and responsibility, particularly when integrating the exact language and ideas of an outside text into one's own writing
 12. Utilize effective grammar recall to check sentences for correct grammar and mechanics
 13. Proofread his/her own and others' prose

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. Relate evolutionary processes to the origin and evolution of cellular life
- O. Explain and apply the major tools and techniques used in biotechnology
- P. Apply methods of scientific inquiry and experimental design to the study of biological concepts
- Q. Perform, document, explain, and interpret a variety of biochemistry, cell, and molecular techniques and experiments.
- R. Acquire, read, evaluate, apply, and cite scientific literature
- S. 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. 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

VI. METHODS OF INSTRUCTION:

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

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. Reece, Jane, Lisa Urry, Michael Cain, Steve Wasserman, and Peter Minorsky. *Campbell Biology*. 11th ed., Pearson, 2017.
2. Russell, Peter, and Paul Hertz. *Biology: The Dynamic Science*. 4th ed., Cengage, 2017.
3. Ho, Nan. Biology 1: Cell Biology Custom Lab Manual. Pearson Custom Publishing, 2014.
4. Custom lab manuals and handouts

X. OTHER MATERIALS REQUIRED OF STUDENTS:

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