Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108; Total Student Learning Hours: 144-162

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Biology C1001 – Introduction to Biology

3 hours lecture, 3 units

Catalog Description
This lecture course provides the non-biology major with an introduction to living things and their environment. Students develop important critical thinking skills as they learn about the process of science, the building blocks of life, the role and regulation of DNA, how populations change over time, the movement of energy within and between life forms, and how species interact with each other and their surrounds. By the endo of the course, students will be able to apply an understanding of biological concepts to current issues and their impacts on society.

This is a non-majors course and does not serve as a prerequisite for Pre-Allied Health students. Formerly BIO 130. Not open to students with credit in BIO 130.

Prerequisite
None

Course Content
1) The scientific method and the process of science.
2) Cellular chemistry and biochemistry
    a. Atoms and bonding
    b. Properties of water
    c. Structure and function of biological molecules
3) Cell structure and function
    a. Cells, membranes, and organelles
    b. Prokaryotes versus eukaryotes
    c. Transport across the cell membrane
4) Cellular metabolism
    a. Enzyme structure and function
    b. Photosynthesis
    c. Cellular respiration
    d. Fermentation
5) Cellular division
    a. Prokaryotic binary fission
    b. Eukaryotic cell cycle
    c. Eukaryotic asexual reproduction (mitosis)
    d. Eukaryotic sexual reproduction (meiosis)
6) DNA structure and function
    a. DNA replication
    b. Transcription and translation
    c. Regulation of gene expression
    d. The impact of mutations
    e. The impact of biotechnology
7) Principles of heredity
    a. Mendelian genetics
    b. Non-Mendelian genetics
    c. Application to human genetics

8) Principles of evolution
   a. Evolutionary mechanisms
   b. Evolutionary evidence
   c. Speciation and classification
   d. The effect of extinction
   e. Survey of biodiversity across Domains
9) Principles of ecology
   a. Biosphere and biomes
   b. Population growth and regulation
   c. Community interactions
   d. Flow of energy and matter in ecosystems
   e. Human interactions with the biosphere
   f. Conservation biology and sustainability

Course Objectives

At the conclusion of this course, the student should be able to:

Part 1:

1) Apply the scientific method, including recognizing the elements of experimental design and interpreting results.
2) Demonstrate scientific literacy by evaluating social, ethical, and equity issues connected to biological sciences.
3) Describe how living things are made of smaller structures that work together to enable to organism to survive.
4) Compare how living things depend on each other and the physical environment as they interact to obtain, change, and exchange matter and energy.
5) Explain how the diversity of living things is the result of evolution of organisms through mechanisms such as heredity, random change, and natural selection.

Part 2:

1) Distinguish among statements that describe a hypothesis, a theory or natural law.
2) Determine whether an entity is living based upon a description of its properties.
3) Classify an organism into the appropriate domain and kingdom based upon its characteristics; justify the reasons for placing it there.
4) Explain how the various components of matter can be organized into biological molecules.
5) Compare and contrast the structures, roles and interrelationships of biological molecules including nucleic acids, proteins, carbohydrates and lipids.
6) Given a molecule of DNA with a specific nucleotide sequence, demonstrate how to create the complementary strands of the double helix, transcribe one of the strands into mRNA, and translate into a peptide.
7) Describe the relationship between structure and function in proteins and the implications of changes in structure on the operation of a cell.
8) Construct a model of a prokaryotic and eukaryotic cell that includes the various sub-cellular structures and describes their inter-relationships and possible origins; contrast this model with that of a typical virus.
9) Construct a model that represents the chemical composition and architecture of a cell membrane and predict the flow of molecules across the membrane based on osmolarity on opposite sides of the membrane.
10) Explain how enzymes allow anabolic and catabolic metabolism in a cell to operate in terms of the cell's energy flow.
11) Describe the processes of photosynthesis, glucose oxidation, and fermentation in terms of their energy flow and conversion properties, and their interrelationships.
12) Compare and contrast the functions and mechanisms of mitosis and meiosis in a diploid organism's life cycle.
13) Solve problems that require calculation of the probability of the inheritance of a particular genetic allele for Mendelian and non-Mendelian scenarios.

Method of Evaluation
Part 1:
Examples of evaluation methods used to observe or measure students' achievement of course outcomes and objectives may include but are not limited to quizzes, exams, projects, evaluation of scientific literature, etc.

Methods of evaluation are at the discretion of local faculty.
Part 2:
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.
1) Quizzes and exams that measure students' ability to recognize, explain and provide examples of the structures, systems and processes associated with living organisms.
2) Written assignments that measure students' ability to analyze contemporary issues in biology based on historical and modern scientific evidence.
3) Research projects that require students to analyze data, interpret and draw conclusions based on scientific sources.
4) Scenario-based problems that model real-world situations and require students to apply classroom/textbook knowledge.

Special Materials Required of Student
None

Minimum Instructional Facilities
Smart classroom

Methods of Instruction
1) Integrated lecture, discussion, demonstration
2) Small and large group discussion
3) In-class individual and group activities/projects
4) Field trips
5) Guest speakers
6) Auxiliary use of study groups, peer tutoring and/or instructional office hours

Out-of-Class Assignments
1) **Reading:** Students will read assigned textbook chapters, lecture notes, and supplemental materials to reinforce core biological concepts such as cell structure and function, genetics, evolution, and ecology. Readings may also include scientific articles, case studies, and multimedia resources that connect biological principles to real-world applications and current issues in health, conservation, and biotechnology.
2) **Writing / Problem Solving:** Students will complete written assignments and problem sets that require application of biological reasoning and quantitative skills to analyze data, interpret graphs, and explain biological phenomena. Assignments may include written reflections on lecture topics, analysis of biological scenarios, and completion of worksheets or study guides that integrate key concepts. Students will also write laboratory reports that include hypotheses, methods, results, and analyses demonstrating understanding of the scientific process.
3) **Other:** None

Texts and References
Texts used by individual institutions and even individual sections will vary.

OER Example:

- Fowler, S., Wise, J., & Roush, R. (2024). Concepts of Biology. OER: OpenStax. https://openstax.org/books/concepts-biology/pages/1-introduction

Traditional Examples:

- Hoefnagels, M. (2021). Biology: The Essentials. 4th Ed.: McGraw Hill
- Taylor, M., Simon, E., Dickey, J., & Reece J. (2020). Campbell Essential Biology. 7th ed.: Pearson

Exit Skills

Students having successfully completed this course exit with the following skills, competencies and/or knowledge:

1) Outline the methods and activities of scientific inquiry used to solve problems in biology, identify limitations to the types of questions that can be answered scientifically, and apply knowledge gained in the course to assess contemporary problems in biology.
2) Distinguish among statements that describe a hypothesis, a theory or natural law.
3) Determine whether an entity is living based upon a description of its properties.
4) Classify an organism into the appropriate domain and kingdom based upon its characteristics and justify the reasons for placing it there.
5) Explain how the various components of matter can be organized into biological molecules.
6) Compare and contrast the structures, roles and interrelationships of biological molecules including nucleic acids, proteins, carbohydrates and lipids.
7) Given a single stranded DNA molecule, create the complementary strand of the double helix, transcribe one of the strands into RNA, and translate into a peptide.
8) Describe the relationship between structure and function in proteins and the implications of changes in structure on the operation of a cell.
9) Construct a model of a prokaryotic and eukaryotic cell that includes the various sub-cellular structures and describes their inter-relationships and possible origins
10) Demonstrate a model that describes the chemical composition and architecture of a cell membrane, describe the different mechanisms for molecular movement across the membrane, and predict the flow of molecules across the membrane based on osmolarity on opposite sides of the membrane.
11) Explain how enzymes allow anabolic and catabolic metabolism in a cell to operate in terms of the cell's energy flow.
12) Describe the processes of photosynthesis, glucose oxidation, and fermentation in terms of their energy flow, conversion properties, and their interrelationships.
13) Compare and contrast the functions and mechanisms of mitosis and meiosis in a diploid organism's life cycle.
14) Solve problems that require calculation of the probability of the inheritance of a particular genetic allele for Mendelian and non-Mendelian scenarios.
15) Appraise the evidence for evolution and illustrate the key concepts using an example.

Student Learning Outcomes

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

1) Utilize factual evidence, appropriate terminology, and the tools of scientific theory to explain how structure contributes to biological function.