Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108;
Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0;
Total Student Learning Hours: 192-216

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Biology C1000 – Introduction to Biology with Lab

3 hours lecture, 3 units
3 hours laboratory, 1 unit
Total units: 4 units

Catalog Description
This combined lecture and laboratory course provides the non-biology major with an introduction to living things and their environment. Students use experimentation and investigation to develop important critical thinking skills. Students 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 surroundings. By the end of the course, students will be able to apply an understanding of biological concepts to current issues and their impacts on society.

This is the first course most nursing and kinesiology majors will take. Formerly BIO 120. Not open to students with credit in BIO 120.

Prerequisite
None

Course Content
Part 1: Required Topics
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

Laboratory Content
1) Process of science and experimental design
2) Personal protective equipment, care and safe use of laboratory equipment
3) Utilization of microscopy to visualize and identify cell structures
4) Cellular transport mechanisms
5) Energy cycling and metabolism
6) Cell division
7) Genetics and inheritance
8) Diversity of life
9) Evolution
10) Ecology

Part 2:
Lecture Content
1) Viruses and their relationship to living organisms
2) Mechanisms of energy acquisition and transformation in cells, including first and second laws of thermodynamics
3) Anabolic and catabolic processes and their interrelationship

Laboratory Content
1) Organic constituents of life including nucleic acids, carbohydrates, proteins and lipids
2) Representative mammalian anatomy

Course Objectives
Part 1:
At the conclusion of this course, the student should be able to:
1) Apply the scientific method, including recognizing the elements of experimental design, gathering and analyzing data, 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 the 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.
6) Collaborate on laboratory investigations of the biological content using appropriate, safe methods and equipment.

Part 2:

Lecture

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.

Laboratory

1) Perform the basic activities of scientific inquiry, including presentation of data in the form of tables, charts and graphs, design of experiments, collection of data, and critical analysis of data.
2) Use both compound and stereo microscopes to study cells and organisms.
3) Describe the relationship between respiration and photosynthesis, producers and consumers and the role of each of these in ecosystems.
4) Relate membrane transport examples to real world situations.
5) Test for the presence of carbohydrates, lipids, proteins and nucleic acids, and recognize the relationships between the testing methods and the chemical properties of these compounds and the significance of these molecules in living organisms.
6) Measure the rate of enzyme catalyzed reactions under different conditions, and explain the significance to living systems.
7) Recognize the roles of light, CO_2 and pigments in photosynthesis and to measure the rate of photosynthesis under different conditions.
8) Compare human-controlled oxidation to glucose oxidation in respiration and to measure the rate of respiration under different conditions.
9) Compare the role of mitosis to meiosis in cellular division and to recognize the different phases of these processes.
10) Solve problems in genetics based on Mendelian and non-Mendelian models of inheritance.

11) Describe the relationship between classical genetics and modern molecular genetics, and the significance of molecular genetics in the modern world.
12) Understand the structure and functional relationships of plants with other biotic and abiotic factors in ecosystems.
13) Study the structure and function of the major organs and organ systems in a representative mammal and compare and contrast to those of humans.
14) Understand the basis of the classification of the animal kingdom as well as recognize members of the different animal phyla.

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, laboratory work, field journals, projects, research demonstrations, 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.
5) Lab practical exams that demonstrate proficiency in specific laboratory skills and knowledge
6) Written and oral lab quizzes
7) Formal and informal lab reports that demonstrate the student's ability to recognize and perform the various activities of scientific inquiry
8) Group discussions and projects that demonstrate ability to construct experiments and analyze data to answer scientific questions

Special Materials Required of Student
None

Minimum Instructional Facilities
Lecture
1) Smart classroom

Laboratory
1) Smart classroom laboratory facilities with writing board, overhead projection system, utilities including hot/cold/DI water
2) Microscopes, both compound and binocular dissecting scopes
3) Computers with software for construction of charts and graphs
4) Equipment including balances, glassware, measuring devices, computer-based data acquisition system

Methods of Instruction
1) Integrated lecture and laboratory exercises, 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
7) Instructional slides, video presentations

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) **Laboratory Preparation and Collaboration:** Outside of class, students will pre-read laboratory exercises, prepare for quizzes, and review background information to ensure active participation during lab sessions. Students will work collaboratively to interpret experimental results, compare findings, and synthesize observations into written lab reports or group presentations. Collaborative problem solving and peer discussions are encouraged to enhance comprehension and deepen understanding of biological systems and processes.
4) **Other:** None

Texts and References

Part 1 (Identical and Required):

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

Textbooks

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.

Lab manuals

An example of a publisher lab manual is:

- Bres, M., & Weisshaar, A. (2018). Thinking About Biology: An Introductory Lab Manual (What's New in Biology). 6th ed.: Pearson.
- Locally developed manual

Part 2:

Lab manuals

1) Cuyamaca College Biology Department. *BIO 120 Laboratory Manual*. Cuyamaca College, 2025.

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.
16) Develop hypotheses design experiments, organize, and critically analyze data to show relationships and conclusions. Communicate results of investigations.
17) Utilize typical laboratory microscopes to recognize and explain the significance of the differences between prokaryotic and eukaryotic cells.
18) Describe the relationship between respiration and photosynthesis, producers and consumers and the role of each of these in ecosystems.
19) Compare and contrast the chemical nature and structure of nucleic acids as well as their role in gene expression.
20) Describe the significance of the relationship between structure and function in biological systems.

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 inquiry to explain how structure contributes to biological function.
2) Collaborate as a member of a team to use the tools and methods of scientific inquiry to solve problems in biology.
3) Formulate hypotheses, and accurately collect, organize, and analyze experimental data to draw meaningful conclusions about proposed hypotheses.
4) Operate laboratory microscopes to observe and distinguish structures within eukaryotic cells and relate these structures to broader cellular functions and organization.