BIO-1110: BIOLOGICAL FUNDAMENTALS

Cuyahoga Community College

Viewing: BIO-1110 : Biological Fundamentals

Board of Trustees:
March 2025

Academic Term:
Fall 2026

Subject Code
BIO - Biology

Course Number:
1110

Title:
Biological Fundamentals

Catalog Description:
Basic principles of cell biology, inorganic chemistry, organic chemistry and biochemistry necessary for study of human anatomy and physiology. Physiological applications of the chemical processes of cellular transport, communication and metabolism emphasized. Laboratory includes use of metric system, basic chemistry techniques and physiological applications.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
3

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
Completion of MATH-0955 Beginning Algebra; or co-enrollment in a co-requisite pairing of MATH-0930 Essential Skills for Algebraic & Quantitative Reasoning and MATH-1190 Algebraic & Quantitative Reasoning; or co-enrollment in a co-requisite pairing of MATH-0970 Essential Skills for Elementary Probability and Statistics I and MATH-1410 Elementary Probability and Statistics; or qualified Math placement.

Outcomes

Course Outcome(s):
Apply fundamental knowledge of biological fundamentals to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):
1. Distinguish between living and nonliving things.
2. Describe the seven characteristics common to all living organisms.
3. Explain why bacteria are alive but viruses are not.
4. Describe the basic principles of evolution, including natural selection.
5. Apply the principles of living characteristics and natural selection to understand human development and evolution.

Course Outcome(s):
Apply scientific methods of inquiry to biochemical laboratory investigations to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Distinguish among an observation, hypothesis, experiment, conclusion, law, and theory.
2. Distinguish between scientific and non-scientific methods of inquiry.
3. Demonstrate understanding of the use of metric system units.
4. Identify common scientific glassware and explain the proper use of each.
5. Use lab equipment/tools to properly collect and analyze data pertaining to biological processes.
6. Apply current knowledge of chemistry and cell biology to solve problems or explain biological phenomena.
7. Use scientific methods of inquiry to gather data and document experimental results in a written format.
8. Demonstrate the ability to analyze experimentally collected data and communicate the results of experimental procedures pertaining to biological processes with others to demonstrate that scientific data is reproducible but can have limitations.
9. Demonstrate safe and proper use of lab equipment and respond appropriately to instructor's feedback as given.

Course Outcome(s):

Apply fundamental knowledge of inorganic chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Discuss the role of energy in chemical reactions.
2. Identify oxidation-reduction reactions and explain their importance in human physiology.
3. Describe what a solution is and what a suspension is and identify solutions and suspensions important to human physiology.
4. Apply the concept of tonicity to osmosis and dialysis.
5. Describe the properties of acids and bases; use the pH scale to describe solutions.
6. Apply knowledge of buffers to physiological systems.
7. Identify important physiological electrolytes.
8. Explain the relationship between pressure, temperature, and volume using gas laws.
9. Relate the gas laws to human respiration.
10. Define radioactivity and identify medical uses of radioactive isotopes.
11. Use the Periodic Chart of Elements to locate atomic number and atomic mass, and to determine the charge of an ion.
12. Differentiate between covalent and ionic compounds based on composition and chemical and physical properties.
13. Explain the difference between ionic, covalent, and hydrogen bonding.
14. Explain why ions are charged particles but ionic compounds are not.
15. Distinguish between polar and nonpolar covalent bonds and relate polarity to properties such as solubility and dissociation.
16. Write and balance a chemical equation using appropriate symbols and recognize major types of chemical reactions.
17. Apply foundational knowledge and discipline-specific concepts to solve problems using solution concentration and gas laws.
18. Explain how inorganic chemistry concepts could be used to understand the modern world and understand the impact of inorganic chemistry on the contemporary world.

Course Outcome(s):

Apply fundamental knowledge of biological chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Describe the cellular functions and physical properties of carbohydrates, lipids, proteins, and nucleic acids.
2. Describe the cellular functions and physical properties of common monosaccharides, disaccharides, and polysaccharides.
3. Define a glycosidic bond.
4. Identify the major classes of lipids and describe the functions of each.
5. Discuss the nature by which lipids form cellular membranes.
6. Compare and contrast the primary, secondary, tertiary, and quaternary protein structure.
7. Define a peptide bond.
8. Compare and contrast the structure of DNA and RNA.

9. Describe the processes of DNA replication, transcription and translation.
10. Use the genetic code to determine an amino acid sequence from a sequence of DNA nucleotides.
11. Explain how enzymes work and relate the importance of enzymes to the chemistry of a living cell.
12. Differentiate between digestion and metabolism.
13. Describe the structure and function of ATP.
14. Identify the following metabolic pathways: glycolysis, protein synthesis, Citric Acid Cycle, and electron transport.

Course Outcome(s):

Apply fundamental knowledge of organic chemistry to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Describe how carbon atoms bond to create compounds and explain the importance of carbon in organic molecules.
2. Define a functional group.
3. Identify common functional groups found in biomolecules.
4. Explain the importance of organic compounds in physiological systems.

Course Outcome(s):

Apply fundamental knowledge of cell biology to succeed in preparatory coursework for the healthcare professions or other scientific studies.

Objective(s):

1. Describe the structural differences between prokaryotic and eukaryotic cells.
2. Explain the structure of the cell membrane and the functions of transmembrane proteins.
3. Apply knowledge of passive and active transport across the cell membrane to physiological systems.
4. Describe the structure and function of organelles: nucleus, mitochondria, smooth endoplasmic reticulum, rough endoplasmic reticulum, Golgi apparatus, lysosomes, and peroxisomes.
5. Explain why some materials can easily cross the cell membrane and others cannot.
6. Distinguish between organelles and inclusions.
7. Explain the functional difference between free and fixed ribosomes.
8. Describe the structure and function of the cytoskeleton. Give examples of ways that the cytoskeleton is important to cell function.

Methods of Evaluation:

1. Written exams
2. Quizzes
3. Assigned homework problems
4. Lab reports
5. Lab practical exams

Course Content Outline:

1. Life
   a. Characteristics of living things
   b. Science vs non-science
   c. Basic principles of evolution, including natural selection
2. Scientific Method and Measurement
   a. Steps in the scientific method
   b. Hypothesis vs theory vs law
   c. Metric system units
   d. Metric system conversions
   e. Common laboratory glassware
   f. Error in measurement
   g. Accuracy vs precision in measurement
   h. Proper measurement of length, weight, volume, and temperature

3. The chemistry of life
    a. Atoms
    b. Ions
    c. Compounds and molecules
    d. Radioactivity
4. Bonding
    a. Ionic bonds
    b. Covalent bonds
        i. polar
        ii. nonpolar
    c. Hydrogen bonds
5. Chemical reactions
    a. Writing and balancing chemical equations
    b. Oxidation reduction reactions
    c. Energy in chemical reactions
    d. Potential vs kinetic energy

6. Water and solutions
    a. Properties of water
    b. Functions of water in the body
    c. Mixtures
    d. Solutions
    e. Suspensions
    f. Concentration
    g. Fluid and electrolyte balance
7. pH and buffer systems
    a. Electrolytes
    b. pH scale
    c. Acids
    d. Bases
    e. Neutralization
    f. Buffer systems
8. Organic molecules
    a. Carbohydrates
    b. Lipids
    c. Protein/enzymes
    d. Nucleic acids
    e. Functional groups
9. The cell
    a. Plasma membrane
        i. structure
        ii. receptors
        iii. transport
    b. Organelles and inclusions
        i. nucleus
        ii. mitochondrion
        iii. smooth endoplasmic reticulum
        iv. rough endoplasmic reticulum
        v. Golgi apparatus
        vi. lysosome
        vii. peroxisome
        viii. free and fixed ribosomes
        ix. pigments and other inclusions
        x. cytoskeleton
    c. Metabolism (chemical reactions in cells)
        i. cellular energy -ATP
        ii. anabolic reactions
        iii. catabolic reactions
        iv. cellular respiration

10. Additional physiological applications
    a. Chemical digestion
    b. Respiration and gas laws
    c. Blood gases
11. Laboratory topics
    a. Metric system
    b. Glassware
    c. Scientific measurement
    d. Cells
    e. Solutions: solubility and concentrations
    f. pH and electrolytes
    g. Carbohydrates
    h. Lipids
    i. Proteins
    j. Enzymes
    k. DNA
    l. Diffusion, osmosis, and dialysis
    m. Gas laws
    n. Cellular respiration

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: https://portal2.tri-c.edu/ReligiousAccommodation/ Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf

Weekly Schedule

	Topics
Week 1	Introduction to Biology
Week 2	Metric System
Week 3	Cells
Week 4	Chemistry Basics, Atoms, Ions, and Molecules
Week 5	Solutions
Week 6	Electrolytes and pH
Week 7	Gas Laws
Week 8	Synthesis of Biomolecules
Week 9	Lipids
Week 10	Carbohydrates
Week 11	Proteins and Enzymes
Week 12	Energy in Chemical Reactions
Week 13	DNA Structure and Function
Week 14	DNA Transcription and Translation
Week 15	Cellular Respiration
Week 16	Final Exam

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Gould, Katherine (editor).Bio 1110:Biological Fundamentals.

Gould, Katherine,et al.Bio 1100 Laboratory Manual.

Resources for the Instructor

Boldyref, Roman. *Health Careers Chemistry Lab*. 20th ed. Van Griner, 2019.

Marieb, Elaine Nicpon. *Essentials of Human Anatomy & Physiology*. 11. Pearson Lifetime eBooks, 2021.

Kenneth Saladin. *Anatomy & Physiology: the unity of form and function*. 10th ed. McGraw-Hill Education, 2024.

Carlos Liachovitzky. *Anatomy and Physiology Preparatory Course Textbook*. New York: City University New York, 2021.

Katherine Gould. *Laboratory Manual for Biological Fundamentals*. Cleveland, 2025.

Denise Guinn. *Essentials of general, organic, and biochemistry*. 3. New York: Macmillan Learning, 2019.

Additional Resources for the Instructor

Clark, Mary Ann, Matthew Douglas, and Jung Choi. *Biology*. 2nd ed. OpenStax, Rice University. 2024. Available online (https://openstax.org/details/books/biology-2e/), also paperback (ISBN-13: 978-1-50669-985-1)

Flowers, Paul, *et al*. *Chemistry*. 2nd ed. OpenStax, Rice University. 2024. Available online (https://openstax.org/details/books/chemistry-2e/), also paperback (ISBN-13: 978-1-59399-578-2)

Instructional Services

OAN Number:

Ohio Transfer 36 TMNS

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