

COURSE OUTLINE

Biology 101 (C-ID Number: BIOL 190) General Biology (C-ID Title: Cell and Molecular Biology)

Catalog Statement

BIOL 101 is the first half of a one-year course designed for biological science majors. It covers fundamental biological principles and processes including: the scientific method, biochemistry, metabolism, cell respiration, photosynthesis, molecular biology, cell structure and function, mitosis and meiosis, Mendelian genetics, molecular genetics, and gene regulation.

Total Lecture Units: 3.0

Total Laboratory Units: 1.0

Total Course Units: 4.0

Total Lecture Hours: 48.0

Total Laboratory Hours: 48.0

Total Faculty Contact Hours: 96.0

Prerequisite: CHEM 101

Course Entry Expectations

Prior to enrolling in the course, the student should be able to:

- describe the scientific method and apply it to the development of the science of chemistry;
- describe chemical processes in terms of chemical equations and be able to use the equations to answer quantitative questions concerning the process described;
- analyze modern theories of atomic motion, especially as they apply to gases;
- utilize bonding theories to describe the chemical nature of ions and molecules;
- demonstrate an understanding of intermolecular forces and apply those forces to the nature of solids and liquids;
- demonstrate the proper use of laboratory equipment and the ability to handle chemicals safely.

Course Exit Standards

Upon successful completion of the required coursework, the student will be able to:

- identify the properties of lipids, carbohydrates, proteins, and nucleic acids;
- describe the structure of prokaryotic and eukaryotic cells;
- explain cell respiration and photosynthesis;
- describe the relationships between meiosis and Mendelian genetics;
- describe the processes of DNA replication, transcription, and translation;

- explain the basic mechanisms of gene regulation in prokaryotes and eukaryotes.
- demonstrate proper use of laboratory equipment including the microscope, spectrophotometer, and micropipettes;
- demonstrate proficiency with data collection, analysis, and graphical representation.

Course Content

Total Faculty Contact Hours = 96.0

Introduction (3 hours)

The scientific method and its current application in biology
Characteristics of living systems
Overview of evolutionary theory as the central paradigm of the biological sciences

Chemistry of Biological Systems (6 hours)

Properties of water
Functional groups and carbon based molecules
Biological monomers and polymers
Carbohydrates, lipids, proteins, and nucleic acids

Cell Biology (6 hours)

Cell size and surface to volume ratio
Prokaryotic and eukaryotic cell structure and function
Cell membrane structure
Active and passive transport across membranes

Cellular Energetics (9 hours)

Laws of thermodynamics
Oxidation-reduction and energy
Phosphorylation
Cellular respiration
Energy, pigments, and light
Light dependent/independent reactions of photosynthesis

Cell Division (3 hours)

Chromosomes, genes, and DNA
Mitosis
Meiosis
Meiotic abnormalities

Mendelian Genetics (9 hours)

Historical perspective of Mendel's work
Mendelian laws
Autosomal and sex-linked patterns of inheritance
Types of dominance
Recombination and linkage maps
Solving genetic problems
Genetic abnormalities

Molecular Genetics (7 hours)

Early work - the search for DNA structure
Watson and Crick's model of DNA structure
DNA replication and repair
Central dogma of molecular biology

- Mutations - origin and types
- Biotechnology techniques
- Gene Regulation (**5 hours**)
 - Basic prokaryotic models
 - Inducible/repressible operons
 - Basic eukaryotic models
 - Transposable elements
- Laboratory Content (**48 hours**)
 - Data analysis and graphing
 - Microscopy and cell structure
 - Diffusion and osmosis
 - Enzyme kinetics
 - Micropipetting
 - Fermentation
 - Photosynthesis with spectrophotometry
 - Modeling mitosis and meiosis
 - Mendelian genetics with statistical analysis
 - Bacterial growth and sterile techniques
 - Bacterial transformation

Methods of Instruction

The following methods of instruction may be used in this course:

- lectures;
- laboratory demonstrations;
- multi-media;
- online.

Out of Class Assignments

The following out of class assignments may be used in this course:

- written lab reports (e.g. describe results of an enzyme kinetics experiment);
- prepare graphs of experimental results.

Methods of Evaluation

The following methods of evaluation may be used in this course:

- lecture examinations (including multiple choice and essay questions);
- laboratory practical examinations;
- evaluation of written lab reports.

Textbooks

Sadava, David E., et al. *Life: The Science of Biology*. 10th ed. New York: W.H. Freeman, 2014.
Print.

13th Grade Textbook Reading Level. ISBN #978-1429298643

Student Learning Outcomes

Upon successful completion of the required coursework, the student will be able to:

- describe and compare the structures of prokaryotic and eukaryotic cells;
- describe, compare, and explain the differences between mitosis and meiosis, and identify cells in different stages of cell division;
- define a gene, explain the processes of transcription and translation, and compare these processes in prokaryotes and eukaryotes;
- explain how organisms acquire energy by photosynthesis and cellular respiration;
- explain the basic principles of Mendelian genetics and solve genetics problems involving autosomal and X-linked genes.