

OSC024 – BIOLOGY I AND II COURSE SEQUENCE

OSC003 – BIOLOGY I

Credit Hours: 4-5 Semester Hours

Related TAGs: Biology, Bioengineering

General Course Description:

This course explores general biological problems and processes as they are experienced by all living organisms: the chemistry and energetics of life, molecular genetics, cell reproduction, and evolution. The course includes a required laboratory using actual biological materials; topics of the lab align to the course. Lecture to include a standard modern general biology text designed for a full-year sequence of introductory biology for science majors or the equivalent at the same level of rigor. Student Learning Outcomes (SLOs) are aligned with the core concepts and competencies which have been identified as foundations of undergraduate biological literacy by the [National Science Foundation/American Association for the Advancement of Science](#).

Core Concepts include:

- I. **Evolution:** The diversity of life is evolved over time by processes of mutation, selection, and genetic change.
- II. **Structure and Function:** Basic units of structure define the function of all living things.
- III. **Information Flow, Exchange and Storage:** The growth and behavior of organisms are activated through the expression of genetic information in context.
- IV. **Pathways and Transformations of Energy and Matter:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
- V. **Systems:** Living systems are interconnected and interacting.

Core Competencies are incorporated into:

- VI. **Perspectives in Biology;** and
- VII. **Practices in Biology**

In order for a course to be approved for OSC003 - Biology I, all of the following must be met:

- 1) Student Learning Outcomes (SLOs) marked with an asterisk (*) are required.
Exception: If marked with a dagger (†), that SLO may be met in either Biology I or II or in both, but must be met in at least one of the two courses.
- 2) At least 70% of the total SLOs including the essential SLOs must be met, with a minimum of one SLO from each core concept and one from each competency in the context of an appropriate concept.
- 3) Core concepts II, III, IV, and V and core competencies VI and VII must be met.
Concept I (Evolution) may be addressed only in Biology II (OSC 004) or in both Biology I (OSC003) and II (OSC004).
- 4) Note that certain SLOs fall under multiple core concepts as indicated by the Roman numerals in parentheses. These SLOs may be used to fulfill *both* core concepts or competencies.

CORE CONCEPTS:

I. EVOLUTION SLOs

1. **Describe the evidence for evolution.*†**
2. **Identify the evolutionary processes that lead to adaptation and biological diversity.*†**
3. Describe how the unity and diversity of life on earth emerge as a result of genetic inheritance through DNA and evolution by natural selection. (III)

II. STRUCTURE AND FUNCTION SLOs

1. Describe basic atomic structure and how atoms combine to form molecules.
2. Explain how the characteristics of life result from unique combinations that occur among a relatively small number of common atoms.
3. Describe the unique properties of the carbon atom, why it is important to life, and the basic ways in which organic molecules are constructed.
4. Describe the basic chemical and physical properties of water and how they facilitate processes essential for life.
5. **Describe the basic structural characteristics and biological importance of carbohydrates, lipids, proteins and nucleic acids.***
6. Apply chemical principles to the analysis of structure and function of biological macromolecules.
7. **Describe the structure and functional role of the cell and its constituent parts.***
8. **Recognize cells as the basic unit of life in all living organisms; compare and contrast the differences between prokaryotic and eukaryotic cells.* †**
9. **Compare plant and animal cell structure and function, including their respective organelles and other components.*†**
10. Describe current models of cell membrane structure and function.

III. INFORMATION FLOW, EXCHANGE, AND STORAGE SLOs

1. **Discuss DNA and its role in heredity, as well as how information from DNA is expressed in cells, and ultimately, the organism.***
2. Compare mechanisms of regulation of gene expression. (V)
3. Describe the structure, function and reproduction of cells, including viruses and microorganisms.
4. **Describe the major steps in a typical eukaryote cell cycle, including the details of mitosis and cytokinesis.* (V)**
5. **Explain the stages of meiosis, their significance, and how meiosis relates to sexual life cycles.***
6. Explain how different types of mutations affect gene products and phenotype. (II)

IV. PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER SLOs

1. Explain how chemical processes impact the cellular processes of life. (II,III)
2. Describe the enzymatic basis of the mechanisms that living organisms use to harvest energy.

3. **Outline the overall organization of the chemical pathways involved in cellular respiration and fermentation and how these pathways accomplish the processing of energy.* (V)**
4. Describe the principles of energy transformations through membrane embedded electron transport chains. (V)
5. **Summarize the overall organization of the chemical pathways involved in photosynthesis and how these pathways accomplish the conversion of light energy into chemical bond energy.* (V)**

V. SYSTEMS SLOs

1. Describe the basic principles of development. (III)
2. **Outline representative mechanisms that cells have evolved for communicating and coordinating their functions in a living organism.***
3. Explain how cell regulatory mechanisms ensure balance in living systems that interact continuously with their environments.
4. Apply knowledge of cellular regulatory mechanisms to explanations of aberrant cell behavior.
5. Describe the process of energy transfer from its source (the sun) through biological systems. (IV)

CORE COMPETENCIES:

VI. PERSPECTIVES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Describe representative historical developments and perspectives in biology, including contributions of significant figures and underrepresented groups and the evolution of theories in biology.
2. Apply knowledge learned from the classroom with real life situations.

VII. PRACTICES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Illustrate the scientific method through analysis of major biological discoveries.
2. Characterize the scientific method and its limitations in the search for answers to biological questions.
3. **Document the solution to scientific problems through collection and analysis of experimental data and the preparation of scientific reports.***
4. **Collect, organize, analyze, interpret, and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge.***
 - a. **Demonstrate the ability to make precise measurements.**
 - b. **Demonstrate basic microscopy skills.†**
 - c. **Prepare and make use of a serial dilution.**
 - d. **Demonstrate safe and proper use of experimental techniques and tools/instruments.**
5. **Utilize current research literature, online information, and information related to scientific and biological issues in the mass media in written or oral reports.* (VI)**
6. Explain the applications and uses of recombinant DNA technologies and genomics, and their impact on society. (VI)

OSC004 – BIOLOGY II

Credit Hours: 4-5 Semester Hours

Related TAG: Biology

General Course Description:

This course explores general biological problems and processes as they are experienced by all living organisms: plant and animal diversity, evolution, basic plant and animal systems, hormones, immunology, and ecology. The course includes a required laboratory using actual biological materials; topics of the lab align to the course. Lecture to include a standard modern general biology text designed for a full-year sequence of introductory biology for science majors or the equivalent at the same level of rigor. Student Learning Outcomes (SLOs) are aligned with the core concepts and competencies which have been identified as foundations of undergraduate biological literacy by the [National Science Foundation/American Association for the Advancement of Science](#).

Core Concepts include:

- I. **Evolution:** The diversity of life is evolved over time by processes of mutation, selection, and genetic change.
- II. **Structure and Function:** Basic units of structure define the function of all living things.
- III. **Information Flow, Exchange and Storage:** The growth and behavior of organisms are activated through the expression of genetic information in context.
- IV. **Pathways and Transformations of Energy and Matter:** Biological systems grow and change by processes based upon chemical transformation pathways and are governed by the laws of thermodynamics.
- V. **Systems:** Living systems are interconnected and interacting.

Core Competencies are incorporated into:

- VI. **Perspectives in Biology;** and
- VII. **Practices in Biology**

In order for a course to be approved for OSC004 - Biology II, all of the following must be met:

- 1) Student Learning Outcomes (SLOs) marked with an asterisk (*) are required.
Exception: If marked with a dagger (†), that SLO may be met in either Biology I or II or in both, but must be met in at least one of the two courses.
- 2) At least 70% of the total SLOs including the essential SLOs must be met, with a minimum of one SLO from each core concept and one from each competency in the context of an appropriate concept.
- 3) All five core concepts and core competencies VI and VII must be met. Concept I (Evolution) may be addressed only in Biology II (OSC004) or in both Biology I (OSC003) and II (OSC004).
- 4) Note that certain SLOs fall under multiple core concepts as indicated by the Roman numerals in parentheses. These SLOs may be used to fulfill *both* core concepts or competencies.

CORE CONCEPTS:

I. EVOLUTION SLOs

1. **Describe the evidence for evolution.*†**
2. **Identify the evolutionary processes that lead to adaptation and biological diversity.*†**
3. Describe the evidence that endosymbiotic events resulted in the evolution of eukaryotic cells from prokaryotic ancestors.
4. Correlate the processes and results of scientific inquiry with the remodeling of animal phylogenetic relationships.
5. Explain how genomic comparisons allow phylogenetic relationships to be determined.

II. STRUCTURE AND FUNCTION SLOs

1. Relate levels of biological organization from cells, the basic unit of life, to the organism and the relationship of structure to function at all levels of biological organization.
2. Explain the basic structures and fundamental processes of life at the molecular, cellular, and organismal levels.
3. **Recognize cells as the basic unit of life in all living organisms; compare and contrast the differences between prokaryotic and eukaryotic cells.*†**
4. **Compare plant and animal cell structure and function, including their respective organelles and other components*†**
5. **Describe the general organization of the animal body and vascular plants.***
6. Describe and contrast reproduction and development in plant and animal systems.
7. Compare the structure of nutrient procurement and processing systems in plants and animals.
8. **Describe the structure and function of the nervous system, the musculo-skeletal system, the respiratory system, and the mechanisms of internal transport and regulation in various organisms.***
9. Explain differences in structure and function among the major invertebrate and vertebrate clades in terms of nutrition, life history, and evolutionary relationships.

III. INFORMATION FLOW, EXCHANGE, AND STORAGE SLOs

1. **Outline the fundamentals of the endocrine system at the systemic level.* (II)**
2. Describe basic processes of infectious disease and defense against infection.

IV. PATHWAYS AND TRANSFORMATIONS OF ENERGY AND MATTER SLOs

1. **Explain how energy moves through an ecosystem.***

V. SYSTEMS SLOs

1. **Explain how regulatory mechanisms at the level of the whole organism ensure balance in living systems that interact continuously with their environments; compare regulatory mechanisms within and across species.* (III)**

2. Describe the relationship between life forms and their environment and ecosystems.
- 3. Describe the different types of relationships that exist between living organisms.***
4. Explain how populations grow and how this can be described mathematically.
5. Describe the basic principles of conservation biology.
- 6. Describe and explain various types of animal behavior.***
7. Describe advantages and disadvantages of social behavior.

CORE COMPETENCIES:

VI. PERSPECTIVES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Describe representative historical developments and perspectives in biology, including contributions of significant figures and underrepresented groups, and the evolution of theories in biology.
2. Compare costs and benefits of preserving endangered species and protecting the environment.
3. Apply knowledge learned from the classroom with real life situations.

VII. PRACTICES IN BIOLOGY SLOs (Demonstrated within the relevant concepts)

1. Illustrate the scientific method through analysis of major biological discoveries.
2. Characterize the scientific method and its limitations in the search for answers to biological questions.
3. Document the solution to scientific problems through collection and analysis of experimental data and the preparation of scientific reports.
- 4. Collect, organize, analyze, interpret, and present quantitative and qualitative data and incorporate them into the broader context of biological knowledge.***
 - a. **Demonstrate the ability to make precise measurements.**
 - b. **Demonstrate basic microscopy skills.†**
 - c. **Demonstrate safe and proper use of experimental techniques and tools/instruments.**
 - d. **Use biological specimens to explain the relationship between structure and function.**
5. **Utilize current research literature, online information, and information related to scientific and biological issues in the mass media in written and oral reports.* (VI)**

**BIOLOGY TAG
FACULTY PARTICIPANTS
September 2015 – September 2016**

Name	Institution
John Plenefisch (Lead)	The University of Toledo
Karen Sirum	Bowling Green State University
Wendy Gagliano	Clark State Community College
Cynthia Conaway-Mavroidis	Cuyahoga Community College
Rachael Detraz	Edison State Community College
Caroline Breitenberger	The Ohio State University
Caryl Tickner	Stark State College