

## Virginia Community College Course Content Summary

**Course Title:** BIO 102 - General Biology II

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### **Course Description**

Focuses on biological processes with a chemical foundation, including macromolecules, cellular structure, metabolism, and genetics in an evolutionary context. Explores the core concepts of evolution; structure and function; information flow, storage and exchange; pathways and transformations of energy and matter; and systems biology. Emphasizes the process of science, interdisciplinary approach, and relevance of biology to society. Part II of a two-course sequence. Lecture 3 hours. Recitation and laboratory 3 hours. Total 6 hours per week. 4 credits

### **General Course Purpose**

Biology 101 and Biology 102 comprise the standard sequence for Introductory Biology for science majors and also serve as a general education science course for non-majors. The courses use an interdisciplinary approach emphasizing the process of science and includes the relevance of science to society. The core concepts covered include: the process of science; evolution; structure and function; information flow, storage and exchange; pathways and transformations of energy and matter; and systems biology. These two courses will expose students to a broad body of biological concepts that will guide them in building and developing skills that they can apply to real world situations. The lecture and laboratory components will emphasize the acquisition and integration of knowledge using the process of science as the basis for inquiry and analysis.

### **Course Prerequisites/Corequisites**

BIO 101 or Departmental Permission

### **Course Objectives**

Upon completing the course, the student will be able to:

#### **Core Competencies**

Competency 1: Process of Science

- Explain the process by which science seeks to understand the world around us.
- Design of a hypothetical experiment to test a hypothesis either given to the student or derived by the student from observations provided.
- Identify the role of observation in this process.
- Define independent and dependent variables

Competency 2: Pathways and Transformations of Energy and Matter

- Describe how energy and matter are related to each other
- Identify the sources of energy in living things
- Identify the sources of matter in living things
- Discuss the processes by which energy enters living systems.
- Describe how living systems use energy to transform matter.

Competency 3: Information Flow, Exchange, and Storage: (primary focus in BIO 101)

- Explain how information is stored in biological systems
- Describe how biological information is accurately replicated and how the information is processed and used by individual cells/organisms.
- Explain how the information flows from generation to generation
- Describe how the information flow results in the observable patterns of inheritance.
- Provide specific examples that show the application of these concepts.

#### Competency 4: Evolution

- Explain the process of evolution by natural selection, including molecular influences and how that process has affected all life forms in the past and continues to do so today.
- Students should be able to summarize the evidence for evolution and modifications made to the basic Darwinian explanation, using historical and current examples.

#### Competency 5: Structure and Function

- Give examples of how structure and function are interrelated in organisms at molecular, cellular, and organismal levels.

#### Competency 6: A Systems Approach to Biology

- Explain how the parts of the system interact to make the functioning system a whole entity.
- Describe the emergent properties in biological systems.

### General Learning Outcomes

#### Scientific Literacy

- Evaluate different perspectives, opinions, and statements about biological issues in terms of their logic, content, scientific merit, and biases.

#### Quantitative reasoning

- Perform accurate calculations, interpret scientific data and graphs, and use results to support conclusions.
- Analyze data collected through experiments in lab. Present and discuss the findings and conclusions derived from data, with chart/spreadsheet and graphs.

#### Critical thinking

- Discriminate among degrees of credibility, accuracy, and reliability of inferences drawn from given data, determine whether certain conclusions or consequences are supported by the information provided and use problem solving skills.

### Additional Course Content

(Core competencies from above that apply to the unit are identified.)

**Evolution:** Evolution and the Origin of Species, Theories of evolution, Modern synthesis, Natural selection, Evolution of Populations, Phylogenies

**Core Competencies:** 1, 4, 5, and 6

- Describe Theory of Evolution by Natural Selection
- Differentiate between convergent and divergent evolutionary processes
- List the evidence that supports evolution
- Differentiate between microevolution and macroevolution
- Illustrate how new species are formed
- Describe the different processes by which natural selection can shape the structure of populations
- Discuss the concept of Modern Synthesis as a unifying framework uniting Mendelian and Darwinian evolutionary ideas
- Describe the processes by which genes flow between populations
- Describe the processes that disrupt gene flow between populations
- Discuss the concept of phylogeny and its significance in understanding evolutionary relationships
- Describe the system of classifying organisms and list the modern tools used in the process

**Multicellularity:** Evolution of multicellularity

**Core competencies:** 1, 4, 5, and 6

- Summarize the current theories on the evolution of the 3 domains of life
- Identify the major characteristics of the three life domains
- Explain current theories on the evolution of multicellular organisms
- List the major divisions of eukaryotes and describe their evolutionary relationships

**Overview of the Animal Kingdom:** Animal classification, Animal Structure and Function Homeostasis, Animal Tissues, Organ systems

**Core competencies:** 4, 5, and 6

- Describe the current understanding of diversity and evolutionary relationships among major animal groups
- Identify the major landmarks in human evolution.
- Compare and contrast positive feedback and negative feedback controls
- Identify the types of animal tissues and describe the tissue characteristics
- List the major organ systems in animals
- Describe the functions of selected organ systems

**Overview of the Plant Kingdom:** Plant evolution, Plant structure and function, Plant transport and function, Plant reproduction

**Core competencies:** 4, 5, and 6

- Differentiate vascular and nonvascular plants
- Identify the major events in the colonization of land by plants
- Compare and contrast reproduction and development in the four major plant groups
- Compare the hierarchical organization consisting of organ, tissues, and cells in vascular and nonvascular plants.
- Identify structures related to resource acquisition
- Describe the growth processes in plants

**Ecology:** Current Issues in Ecology, Biomes, Populations, Communities, Ecosystems, Conservation Biology

**Core competencies:** 1, 2, 4, 5, and 6

- Identify current issues in ecology
- Relate the basic principles of ecology to the diversity and distribution of organisms on earth
- Identify the different terrestrial biomes and differentiate them from the aquatic biomes
- Identify and describe the factors that govern population growth
- Describe the ecological interactions that maintain ecological communities
- Outline the basic principles that govern and maintain ecosystems
- Analyze how human activities impact ecosystems

**Major Topics to be Included**

**Evolution:** Evolution and the Origin of Species, Theories of evolution, Modern synthesis, Natural selection, Evolution of Populations, Phylogenies

**Multicellularity:** Evolution of multicellularity

**Overview of the Animal Kingdom:** Animal classification, Animal Structure and Function Homeostasis, Animal Tissues, Organ systems

**Overview of the Plant Kingdom:** Plant evolution, Plant structure and function, Plant transport and function, Plant reproduction

**Ecology:** Current Issues in Ecology, Biomes, Populations, Communities, Ecosystems, Conservation Biology