

## Curriculum Guide

**Course 523:** Honors Biology

**Level:** Grades 9 & 10

### 1. Course Structure

This full-year course meets five class periods each week. Two of these periods are scheduled back-to-back for laboratory purposes.

### 2. Intended Audience

Honors Biology is a course intended for freshmen/sophomore students who are currently enrolled in Honors or CPI math and/or are recommended by their previous science teacher for the program.

### 3. Course Goals

Students in this course will develop a solid, introductory level foundation in general biological principles, including laboratory skills. They will also strengthen their critical thinking and application skills, permitting clear expression of ideas, both orally and in writing.

### 4. Course Objectives

Content:

- The Biological and Chemical Nature of Living Things
- Form and Function: The Cellular Basis of Life
- Genetics
- Evolution: Change and Diversity
- Ecological Interactions
- Human Biology

Skills:

- Students will demonstrate an understanding of the relationship between structure and function of living organisms.
- Students will apply knowledge of key biological principles and concepts as they solve new problems and master new concepts and skills.
- Students will consistently demonstrate safe laboratory practices.
- Students will become proficient in observing, recording, analyzing, and reporting laboratory experiments and in essential laboratory techniques such as microscopy and various physiological analyses.
- Students will be knowledgeable in designing and conducting biological investigations.

### 5. Essential Questions

The Biological and Chemical Nature of Living Things

- What is the significance of carbon in organic molecules?
- What are the six most common elements in organic molecules?
- What are the functions of carbohydrates, lipids, proteins and nucleic acids?
- Of what are carbohydrates, lipids, proteins and nucleic acids composed and what are their general structures?
- How do dehydration synthesis and hydrolysis relate to organic molecules?
- What is the role of enzymes in biochemical reactions?

Form and Function: The Cellular Basis of Life

- What are the individual functions of cell organelles and how do they work together as a cellular unit?
- What are the differences between prokaryotic cells and eukaryotic cells?
- How do the structures of plant and animal cells relate to their functions?
- Why do cells function in a narrow range of physical conditions, such as temperature and pH?
- How does the structure of the cell membrane relate to its function?
- What reactants and products are associated with the general process of photosynthesis?
- How are isotopes used to identify the chemical components of photosynthesis?
- What role do photosynthetic plants play in the transfer of energy and nutrients within an ecosystem?
- How does cellular respiration convert food energy into the cellular energy of ATP?
- What are the connections between the related processes of photosynthesis and cellular respiration?
- What is the role of mitosis in the cell cycle?
- What are the differences between cell division by mitosis and by meiosis?

#### Genetics

- What is the structure and function of DNA?
- How does DNA replicate?
- How are genes expressed via transcription and translation? What is the general pathway by which ribosomes synthesize proteins by using tRNAs to translate genetic information encoded in mRNAs?
- How is the expression of genes regulated by the cell?
  - How do mutations in DNA sequence lead to phenotypic change in an organisms and in its offspring? How can DNA mutations sometimes be silent?
- What are dominant, recessive, codominant, polygenic and sex-linked traits? How do their phenotypic ratio patterns differ?
- What are Mendel's laws of segregation and independent assortment? How do these laws relate to meiosis? How do linked genes relate to these concepts?
- What are Punnett Squares, and how are they used to determine the genotype and phenotype ratios of mono- and dihybrid crosses?
- How are zygotes produced in the fertilization process?
- How are viruses similar and different to living cells?

#### Evolution: Change and Diversity

- How do the fossil record and other evidence support the theory of evolution?
- How is genetic variation preserved or eliminated from a population through Darwinian natural selection (organic evolution), and how does it result in biodiversity?
- How does the taxonomic system classify living things into domains and kingdoms?

#### Ecological Interactions

- How do biotic and abiotic factors cycle within an ecosystem (water, carbon, oxygen, and nitrogen)?
- How are food webs utilized to identify and distinguish between producers, consumers, and decomposers as well as explain the transfer of energy through trophic levels?
- What are the factors in an ecosystem that influence fluctuations in population size?
- What changes occur in an ecosystem resulting from natural causes, changes in climate, human activity, or introduction of non-native species?
- How do symbiotic behaviors produce interactions within ecosystems?

## Human Biology

- How does the anatomy of the functional units (e.g. nephron, sarcomere, alveoli) of the major organ systems in humans perform the function of that organ system?
- How are the functions of individual systems within humans integrated to maintain homeostasis in the body?

## 6. Course Outline/ Curriculum Map

### Quarter 1

- Introduction
- Characteristics of Life
- Scientific method
- Unifying concepts of animal structure and function
- Basic chemistry
- Basic biochemistry
- Nutrition/digestion
- Microscopes
- Limits in cell size
- Cell parts & functions
- Energy & enzymes
- Cell transport
- Prokaryotes vs. eukaryotes
- Respiration
- Circulation
- Excretion

### Quarter 2

- Cellular Respiration
- How animals move
- Fermentation
- Photosynthesis
- Mitosis
- Meiosis
- Inheritance

- Human reproduction and development

### Quarter 3

- Replication
- Protein synthesis
- Gene expression
- Endocrine system
- DNA technology
- Darwin and Natural selection
- Geological time scale
- Evidence of Evolution
- Microevolution
- Origin of Species
- Origin and evolution of microbial life and evolution of animal diversity
- Phylogenetics

### Quarter 4

- Nervous system
- The senses
- Dissections
- Ecology
- Biosphere & biomes
- Populations, ecosystems & communities
- Conservation

## 7. Course Text and Other Materials

The text for this course is:

Campbell, Neil A. et al. Biology: Concepts & Connections, 4<sup>th</sup> ed. San Francisco, Benjamin Cummings, 2003.

Support materials include:

CD-ROM included with text

## 8. Instructional Methods and Course Activities

Content will be conveyed through:

- Class dialogue and discussion
- Laboratory investigations (instructor and student designed)
- Inquiry investigations
- Technology integrated activities
- Student oriented manipulative activities
- Topic lectures and demonstrations

- Oral and visual presentations (student and instructor designed)

#### **9. Learning Strategies**

- The primary instructional mode will include class dialogue and discussion along with topic lectures and laboratory experiments, which are carefully selected to complement classroom work and also to ensure the mastery of essential laboratory skills and topic concepts.
- Students will be encouraged to approach each learning experience with an objective, critical, and insightful attitude.
- The dynamic nature of biological systems and the interdependent behaviors of their components will be stressed throughout the program.
- Research-oriented projects will be used to augment classroom work and to support varying learning styles.

#### **10. Assessment**

The assessment of students will occur through:

- Daily evaluation of class preparation and participation
- Laboratory performance, including data collection and critical analysis
- Accurate completion of homework assignments
- Formal assessments
- Quarterly research projects

#### **11. Course Evaluation**

The assessment of this course will occur through:

- On-going feedback from current and former students
- Reviews of student performance overall throughout the school year
- End of year evaluation completed by students