AP Biology Course Objectives

I. MOLECULES & CELLS

A. Unit One: The Nature of Science

Objectives

a. How is the scientific method used to solve problems?
b. What is the importance of controls?
c. How does Darwin’s theory of evolution illustrate how science works?

B. Unit Two: The Chemistry of Life

Objectives

a. How do the unique chemical and physical properties of water make life on earth possible?
b. What is the role of carbon in the molecular diversity of life?
c. How do cells synthesize and break down macromolecules?
d. How do structures of biologically important molecules (carbohydrates, lipids, proteins, nucleic acids) account for their functions?
e. How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
f. How do enzymes regulate the rate of chemical reactions?
g. How does the specificity of an enzyme depend on its structure?
h. How is the activity of an enzyme regulated?

C. Unit Three: The Biology of the Cell

Objectives

a. What are the similarities and differences between prokaryotic and eukaryotic cells?
b. What are the evolutionary relationships between prokaryotic and eukaryotic cells?
c. What is the current model of the molecular architecture of membranes?
d. How do variations in this structure account for functional differences among membranes?
e. How does the structural organization of membranes provide for transport and recognition?
f. What are various mechanisms by which substances cross membranes?
g. How do cells interact and communicate with each other?
h. How does compartmentalization organize a cell’s functions?
i. How are the structures of the various subcellular organelles related to their functions?
j. How do organelles function together in cellular processes?
k. What factors limit cell size?
l. How does the cell cycle assure genetic continuity?
m. How does mitosis allow for the even distribution of genetic information to new cells?
n. What are the mechanisms of cytokinesis?
o. How is the cell cycle regulated?
p. How can aberrations in the cell cycle lead to tumor formation?
D. Unit Four: Cellular Energetics

Objectives

a. What is the role of ATP in coupling the cell’s anabolic and catabolic processes?
b. How does chemiosmosis function in bioenergetics?
c. How are organic molecules broken down by catabolic pathways?
d. What is the role of oxygen in energy-yielding pathways?
e. How do cells generate ATP in the absence of oxygen?
f. How are the processes regulated?
g. How does photosynthesis convert light energy into chemical energy?
h. How are the chemical products of the light-trapping reactions coupled to the synthesis of carbohydrates?
i. What kinds of photosynthetic adaptations have evolved in response to different environmental conditions?
j. What interactions exist between photosynthesis and cellular respiration?

II. Heredity and Evolution

A. Unit Five: Heredity

Objectives

a. What features of meiosis are important in sexual reproduction?
b. Why is meiosis important in heredity?
c. How is meiosis related to gametogenesis?
d. What are the similarities and differences between gametogenesis in animals and plants?
e. How is genetic information organized in the eukaryotic chromosome?
f. How does this organization contribute to both continuity of and variability in the genetic information?
g. How does crossing over contribute to an increase in variability?
h. How did Mendel’s work lay the foundation of modern genetics
i. What are the principle patterns of inheritance?
j. How do genes interact to produce altered phenotypes?
k. How does the environment affect the expression of phenotypes?
l. How are genetic disorders and diseases diagnosed and what treatments are available?
m. What is The Genome Project, Stem Cells & Cloning? What are the ethical concerns? What is in the future?
B. **Unit 6: Molecular Biology**

**Objectives**

a. How do the structure of nucleic acids relate to their functions of information storage and protein synthesis?
b. What are the similarities and differences between prokaryotic and eukaryotic genomes and protein synthesis?
c. How was the structure and function of DNA and RNA elucidated?
d. What are some mechanisms by which gene expression is regulated in prokaryotes and eukaryotes?
e. In what ways can genetic information be altered?
f. What are some effects of these alterations?
g. What is the structure of viruses?
h. What are the major steps in viral reproduction?
i. How do viruses transfer genetic material between cells?
j. What are some current recombinant technologies?
k. What are some practical applications of nucleic acid technology?
l. What legal and ethical problems may arise from these applications of nucleic acid technology?

C. **Unit 7: Evolutionary Biology**

**Objectives**

a. What are the current biological models for the origins of biological macromolecules?
b. What are the current models for the origins of prokaryotic and eukaryotic cells?
c. What types of evidence support an evolutionary view of life?
d. What are gene frequencies and what factors result in their change?
e. What is the role of natural selection in the process of evolution?
f. How are heredity and natural selection involved in the process of evolution?
g. What mechanisms account for speciation and macroevolution?
h. What different patterns of evolution have been identified and what mechanisms are responsible for each of these patterns?
III. ORGANISMS AND POPULATIONS

A. Unit 8: Diversity of Organisms

Objectives
a. What are the major body plans of plants and animals?
b. What are representative organisms from the Monera, Fungi, and Protista?
c. What are representative members of the major animal phyla and plant divisions?
d. What are the distinguishing characteristics of each group (kingdoms and the major phyla and divisions of animal and plants)?
e. What is some evidence that organisms are related to each other?
f. How do scientists study evolutionary relationships among organisms?
g. How is this information used in classification of organisms?

B. Unit 9: Structure and Function of Plants

Objectives
a. What patterns of reproduction and development are found in plants and how are they regulated?
b. What is the adaptive significance of alternation of generations in the major groups of plants?
c. How does the organization of cells and tissues determine structure and function in plant systems?
d. How are structure and function related in the various cells and tissues?
e. What adaptive features have contributed to the success of various plants on land?

C. Unit 10: Structure and Function of Animals

Objectives
a. What patterns of reproduction and development are found in animals and how are they regulated?
b. How does the organization of cells, tissues, and organs determine structure and function in animal systems?
c. How are structure and function related in the various organ systems?
d. How do the organ systems of animals interact?
e. What adaptive features have contributed to the success of various animals on land?
f. What are the responses of animals to the environmental cues and how do hormones mediate them?
D. *Unit 11: Ecology*

Objectives

a. What models are useful in describing the growth of a population?
b. How is population size regulated by abiotic and biotic factors?
c. How is energy flow through an ecosystem related to trophic structure (trophic levels)?
d. How do elements (e.g., carbon, nitrogen, phosphorus, sulfur, oxygen) cycle through ecosystems?
e. How do organisms affect the cycling of elements and water through the biosphere?
f. How do biotic and abiotic factors affect community structure and ecosystem function?
g. How does succession affect change in a community?
h. What are the various biomes and what factors determine their location and characteristics?
i. In which ways are humans affecting biogeochemical cycles?
j. How does a population growth affect the food supply?