

AP Biology Themes

Theme	<u>I. Molecules and Cells</u>	<u>II. Heredity and Evolution</u>	<u>III. Organisms and Populations</u>
	<p><u>Cells</u>: the structural and functional units of life; processes based on physical and chemical changes</p>	<p><u>Heredity</u>: controls passage of structural & functional info to next generation</p>	<p>Relationship of structure to function in organisms: interactions of organism with environment</p>
<i>I. Science as a Process</i>	<p>How did Melvin Calvin and his students discover the sugar-producing cycle of photosynthesis?</p> <p>Experiments with artificial membranes have added to our understanding of the structure and function of the plasma membrane.</p>	<p>How do we know DNA is the genetic material?</p> <p>X-ray diffraction, model building, and analysis of base pairing led to the development of the double helix model of DNA.</p>	<p>What can long-term ecological research teach us about human impact on the biosphere?</p> <p>Measurements of rates of transpiration using parts of plants have helped biologists understand the roles of the roots and the leaves.</p>
<i>II. Evolution</i>	<p>Chemical evolution on a young Earth set the stage for the origin of life.</p> <p>C₄ and CAM plants represent structural and biochemical adaptations for photosynthesis in hot and dry climates.</p>	<p>Mutations and genetic recombination generate heritable variation that is subjected to natural selection.</p> <p>Natural selection occurred in early pre-life forms, as coacervates possessing enzymes for synthesis of various metabolites had more options for energy utilization and thus were more likely to survive.</p>	<p>When a population's local environment changes unfavorably, the population adapts, migrates, or dies.</p> <p>The system of taxonomy used by most biologists today reflects our current understanding of phylogenetic relationships among organisms.</p>
<i>III. Energy Transfer</i>	<p>Plants transform light energy into chemical energy.</p> <p>A proton gradient across membranes powers the synthesis of ATP in mitochondria, chloroplasts, and prokaryotes.</p>	<p>A cell must spend energy to transcribe and translate a gene because entropy decreases as monomers are organized into complex macromolecules.</p> <p>Energy released by the hydrolysis of ATP is used by cells in DNA synthesis, transcription, and translation.</p>	<p>Energy flows from producers to consumers in an ecosystem.</p> <p>Ion pumps in membranes reestablish a transmembrane resting potential after a neuron fires an impulse or a muscle fiber contracts.</p>
<i>IV. Continuity and Change</i>	<p>The cell cycle clones a cell's DNA.</p> <p>The process of mitosis allows for genetic continuity from generation to generation while at the same time, through mutation, provides for diversity.</p>	<p>Like begets like, but not exactly, as mutations and sex generate new genetic combinations.</p> <p>Changes in gene pools over time can be explained in part by natural selection for the most fit genotypes.</p>	<p>Homologous structures are variations on a common ancestral prototype.</p> <p>Organogenesis results from differential gene activation in various regions of an embryo at various times.</p>

<p><i>V. Relationship of Structure to Function</i></p>	<p>The distinctive functions of starch and cellulose reflect structural differences in these two polysaccharides.</p> <p>The membranous organization of the mitochondrion orders the process of cellular respiration.</p>	<p>By discovering the structure of DNA, Watson and Crick deduced how genes replicate.</p> <p>The complementary nature of the two DNA strands explains replication.</p>	<p>The large surface area of the mammalian small intestine increases absorption of nutrients.</p> <p>Morphological adaptations of parasites to their hosts enhance their survival.</p>
<p><i>VI. Regulation</i></p>	<p>Control of the flow of molecules across the membrane maintains a favorable intracellular environment.</p> <p>Regulator molecules in the cell interact with some enzymes and control their activity by changing the shape of the enzymes.</p>	<p>Regulatory mechanisms switch genes on and off in response to environmental cues.</p> <p>A balanced polymorphism can exist within a population, in which two or more alleles can be kept in the gene pool by the action of predators that selectively prey on the most common phenotype.</p>	<p>The nervous and endocrine systems mediate an animal's responses to changes in the environment.</p> <p>Hormones regulate the growth and development of both plants and animals.</p>
<p><i>VII. Interdependence in Nature</i></p>	<p>At the metabolic level, photosynthesis and cellular respiration are mutually symbiotic.</p> <p>Energy for many biosynthetic processes is provided by the hydrolysis of ATP. In turn, the synthesis of ATP is coupled to the oxidation of organic fuels.</p>	<p>An organism's phenotype is the synergistic product of genes and environment.</p> <p>The sporophyte and gametophyte generations of a plant are interdependent.</p>	<p>Destruction of tropical forests has global consequences.</p> <p>Competition, predation, and parasitism between populations in a food web contribute to the stability of an ecosystem.</p>
<p><i>VIII. Science, Technology, and Society</i></p>	<p>Advances in cancer research depend on progress in our basic understanding of how cells work.</p> <p>Various new techniques in microscopy have led us to a better understanding of basic cell structure and function.</p>	<p>DNA technology is a double-edged sword, promising health advances and posing new ethical issues.</p> <p>Biotechnology has provided new treatments for various genetic diseases, developed crops with better yields, and provided solutions for environmental problems.</p>	<p>More people utilizing more technology have generated many current global problems.</p> <p>An understanding of basic ecological principles can help us to assess the human impact on the biosphere and to begin to develop solutions to some human-caused environmental imbalances.</p>