AP Biology
Course Outline

Big Topic 1- Molecules and Cells (25%)

A. Chemistry of Life (7%)

1. Water	Chap. 3
2. Organic molecules in organisms	Chap. 4

B. Cells (10%)

1.Prokaryotic and eukaryotic cells	Chap. 6
3. Subcellular organization	Chap. 6
2. Membranes	Chap .7
4. Cell cycle and its regulation	Chap. 12

C. Cellular Energetics (8%)

1. Free energy changes	Chap. 8
2. Enzymes	Chap. 8
3. Fermentation and cellular respiration	Chap. 9
4. Photosynthesis	Chap. 10

Big Topic 2 - Heredity and Evolution (25%)

A. Heredity (8%)

1. Meiosis and gametogenesis	Chap. 13
2. Inheritance patterns	Chap. 14

B. Molecular Genetics (9%)

1. RNA and DNA structure and function	Chap. 16
2. Gene regulation	Chap. 17
4. Viral structure and replication	Chap. 18
5. Nucleic acid technology and applications	Chap. 20

C. Evolutionary Biology (8 %)

1. Early evolution of life	Chap. 26
2. Evidence for evolution	Chap. 26
3. Mechanisms of evolution	Chap. 22

Big Topic III - Organisms and Populations (50%)

A. Diversity of Organisms (8%)

1. Evolutionary patterns	Chap.23-24
2. Survey of the diversity of life	Chap.27-34
3. Phylogenetic classification	Chap.25
4. Evolutionary relationships	Chap.26

B. Structure and Function of Plants and Animals (32%)

1. Reproduction, growth, and development	Chap.35-39
2. Structural, physiological, and behavioral adaptations	Chap. 40-47
3. Response to the environment	Chap. 48-49

C. Ecology (10%)

1. Population dynamics	Chap. 50-52
2. Communities and ecosystems	Chap. 54
3. Global issues	Chap. 55

Note: Percentages are estimates of course and exam coverage

AP Biology
Annotated Course Outline

Unit I. Molecules and Cells: Cells are the structural and functional units of life; cellular processes are based on physical and chemical changes.

A. Chemistry of Life

1. *Water**(Chap 3)***
   How do the unique chemical and physical properties of water make life on earth possible?
2. *Organic molecules in organisms **(Chap 4, 5)***
   What is the role of carbon in the molecular diversity of life?
   How do cells synthesize and break down?
   How do structures of biologically important molecules (carbohydrates, lipids, proteins, nucleic acids) account for their functions?

B. Cells

1. *Prokaryotic and eukaryotic cells **(Chap 6)***
   What are their similarities and differences?
   What are their evolutionary relationships?
2. *Subcellular organization **(Chap 6)***
   How does compartmentalization organize a cell's functions?
   How are the structures of the various subcellular organelles related to their functions?
   How do organelles function together in cellular processes?
   What factors limit cell size?

Unit II – Cellular Membranes and Energy. Cells are defined by their membranes and these membranes allow cells to maintain homeostasis. Energy is required for cells to do work (growing, moving, and reproducing)

A. **Membranes**

1. *Membranes **(Chap 7)***
   What is the current model of the molecular architecture of membranes?
   How do variations in this structure account for functional differences among membranes?
   How does the structural organization of membranes provide for transport and recognition?
   What are various mechanisms by which substances cross membranes?

B. **Energy**

2. *Free energy changes **(Chap 8)***
   How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
3. *Enzymes **(Chap 8)***
   How do enzymes regulate the rate of chemical reactions?
   How does the specificity of an enzyme depend on its structure?
   How is the activity of an enzyme regulated?
4. *Coupled reactions**(Chap 8)***
   What is the role of ATP in coupling the cell's anabolic and catabolic processes?
   How does chemiosmosis function in bioenergetics?
5. *Fermentation and cellular respiration **(Chap 9)***
   How are organic molecules broken down by catabolic pathways?
   What is the role of oxygen in energy-yielding pathways?
   How do cells generate ATP in the absence of oxygen?

6. *Photosynthesis* ***(Chap 10)***
   How does photosynthesis convert light energy into chemical energy?
   How are the chemical products of the light-trapping reactions coupled to the synthesis of carbohydrates?
   What kinds of photosynthetic adaptations have evolved in response to different environmental conditions?
   What interactions exist between photosynthesis and cellular respiration?

Unit III. Heredity and Evolution: Hereditary events control the passage of structural and functional information from one generation to the next.

A. **Heredity**

1. *Cell cycle and its regulation* **(Chap 12)**
   How does the cell cycle assure genetic continuity?
   How does mitosis allow for the even distribution of genetic information to new cells?
   What are the mechanisms of cytokinesis? How is the cell cycle regulated?
   How can aberrations in the cell cycle lead to tumor formation?

2. *Meiosis and gametogenesis* **(Chap 13)**
   What features of meiosis are important in sexual reproduction?
   Why is meiosis important in heredity? How is meiosis related to gametogenesis?
   What are the similarities and differences between gametogenesis in animals and gametogenesis in plants?

3. *Eukaryotic chromosomes* ***(Chap 15)***
   How is genetic information organized in the eukaryotic chromosome?
   How does this organization contribute to both continuity of and variability in the genetic information?

4. *Inheritance patterns* ***(Chap 14)***
   How did Mendel's work lay the foundation of modern genetics? What are the principal patterns of inheritance?

B. **Molecular Genetics**

1. *RNA and DNA structure and function* ***(Chap 16)***
   How do the structures of nucleic acids relate to their functions of information storage and protein synthesis?
   What are the similarities and differences between prokaryotic and eukaryotic genomes?
2. *Gene regulation* ***(Chap 17)***
   What are some mechanisms by which gene expression is regulated in prokaryotes and eukaryotes?
3. *Mutation* ***(Chap 17)***
   In what ways can genetic information be altered?
   What are some effects of these alterations?
4. *Viral structure and replication* ***(Chap 18)***
   What is the structure of viruses?
   What are the major steps in viral reproduction?
   How do viruses transfer genetic material between cells?
5. *Nucleic acid technology and applications* ***(Chap 20)***
   What are some current recombinant technologies?
   What are some practical applications of nucleic acid technology?
   What legal and ethical problems may arise from these applications?

C. Evolutionary Biology

1. *Early evolution of life* ***(Chap 26)***
   What are the current biological models for the origins of biological macromolecules?
   What are the current models for the origins of prokaryotic and eukaryotic cells?
2. *Evidence for evolution* ***(Chap 25. 26****)*
   What types of evidence support an evolutionary view of life?
3. *Mechanisms of evolution* ***(Chap 22,23)***
   What is the role of natural selection in the process of evolution?
   How are heredity and natural selection involved in the process of evolution?
   What mechanisms account for speciation and macroevolution?
   What different patterns of evolution have been identified and what mechanisms are responsible for each of these patterns?

IV. Organisms and Populations: The relationship of structure to function is a theme that is common to all organisms; the interactions of organisms with their environment is the major theme in ecology.

A. Diversity of Organisms

1. *Evolutionary patterns* ***(Chap 26)***
   What are the major body plans of plants and animals?
2. *Survey of the diversity of life* ***(Chap 27 – 34)***
   What are representative organisms from the Bacteria, Archaea, and Eukarya?
   What are representative members of the major animal phyla and plant divisions?
3. *Phylogenetic classification* ***(Chap 25)***
   What are the distinguishing characteristics of each group (domains, kingdoms and the major phyla and divisions of animals and plants)?
4. *Evolutionary relationships* ***(Chap 26)***
   What is some evidence that organisms are related to each other?
   How do scientists study evolutionary relationships among organisms?
   How is this information used in classification of organisms?

B. Structure and Function of Plants and Animals

1. *Reproduction, growth, and development* ***(Chap 46-47)***
   What patterns of reproduction and development are found in plants and animals and how are they regulated?
   What is the adaptive significance of alternation of generations in the major groups of plants?
2. *Structural, physiological, and behavioral adaptations* ***(Chap 40-45)***
   How does the organization of cells, tissues, and organs determine structure and function in plant and animal systems?
   How are structure and function related in the various organ systems?
   How do the organ systems of animals interact?
   What adaptive features have contributed to the success of various plants and animals on land?
3. *Response to the environment* ***(Chap 48 – Chap 49)***
   What are the responses of plants and animals to environmental cues, and how do hormones mediate them?

C. Ecology

1. *Population dynamics*
   What models are useful in describing the growth of a population?
   How is population size regulated by abiotic and biotic factors?
2. *Communities and ecosystems*
   How is energy flow through an ecosystem related to trophic structure (trophic levels)?
   How do elements (e.g., carbon, nitrogen, phosphorus, sulfur, oxygen) cycle through ecosystems?
   How do organisms affect the cycling of elements and water through the biosphere?
   How do biotic and abiotic factors affect community structure and ecosystem function?
3. *Global issues*
   In which ways are humans affecting biogeochemical cycles?