

## Planned Course Guide

**Title of Planned Course:** AP Biology

**Subject Area:** Science

**Grade Level:** 11, 12

**Course Description:** AP Biology is our advanced placement course focusing on the concepts of evolution, the use of free energy to maintain homeostasis, the storage and transmission of genetic information, and the interactions between biological systems. This course focuses on the analysis of biological concepts to create a deep understanding of the newly updated big ideas stated by the College Board in 2012. Students taking this course will culminate their rigorous studies by taking the AP Biology exam.

**Time/Credit for this Course:** One Full Academic Year/ 1.0 Credits

**Curriculum Writing Committee:** Ashley White

## Planned Course Materials

**Course Title:** AP Biology

**Textbook:** Biology: AP Edition, 7<sup>th</sup> Edition – Campbell & Reece, 2005

**Supplemental Books:**

- Biology: The Unity and Diversity of Life, 10<sup>th</sup> Edition – Starr & Taggart, 2004
- Practicing Biology: A Student Workbook, 5<sup>th</sup> Edition – Heitz & Giffen, 2014

**Teacher Resources:**

- myap.collegeboard.org classroom materials (videos/question bank/unit guides)
- AP Biology Course and Exam Description, The College Board, Effective Fall 2020

## Curriculum Map

**August/September:** Unit 1 - Chemistry of Life (1.1-1.6)

Water Chemistry, Organic Molecules, Nutrient Cycling

**September/October:** Unit 2 - Cell Structure and Function (2.1-2.11)

Eukaryotes & Prokaryotes, Subcellular structures, Osmoregularity, Transport Mechanisms, Compartmentalization

**October/November:** Unit 3 - Cellular Energetics (3.1-3.7)

Enzyme structure and function, ATP, Photosynthesis, Cellular Respiration

**November/December:** Unit 4 - Cell Communication and Cell Cycle (4.1-4.7)

Signal Transduction Pathways, Feedback mechanisms, Cell cycle

**December/January:** Unit 5 - Heredity (5.1-5.6)

Meiosis, Genetic Diversity, Mendelian genetics, Non-Mendelian genetics, Chromosomal inheritance

**January/February:** Unit 6 - Gene Expression and Regulation (6.1-6.8)

DNA and RNA structure, Transcription, Translation, Mutations, Biotechnology

**February/March:** Unit 7 - Natural Selection (7.1 - 7.13)

Natural selection, Population genetics, Hardy-Weinberg Equilibrium, Evolution, Speciation, Life Origins

**March/April:** Unit 8 - Ecology (8.1-8.7)

Energy Flow through ecosystems, Population ecology, Community ecology, Biodiversity, Ecosystems

**April/May:** Anatomy and Physiology

Nervous system, Neuron action potentials, Immune responses, Muscle contraction

**May/June:** AP Exam

Lab Review, Practice Exams, Current Biotechnology and Conservation efforts

**June:** Student Projects – Current Events in Biology, Careers in Biology

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Chemistry of Life

**Time frame:** 10 class blocks

**State Standards:** 3.1.12.A5, 3.1.12.B5

**Anchor(s) or adopted anchor:** BIO.A.2.1, BIO.A.2.2, BIO. A.2.1.3

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function
- Describe the composition of biological macromolecules required by living organisms
- Describe the properties of the monomers and the types of bonds that connect the monomers in biological macromolecules
- Explain how a change in the subunits of a polymer may lead to changes in structure or function of the macromolecule
- Describe the structural and functional differences between RNA and DNA

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index card summaries
- Macromolecule ID worksheets

**Extensions:**

- MyAP Classroom Question Bank
- Additional worksheets on macromolecule ID

**Remediation:**

- Study Island
- MyAP Unit Videos
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during student work time
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets
- MyAP Classroom

**Assessments:**

- Teacher generated tests
- Macromolecule ID Quiz
- Homework
- Student participation
- Questioning during direct instruction

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Cell Structure and Function

**Time frame:** 9 Blocks

**State Standards:** 3.1.12.A1, 3.1.12.A5, 3.1.12.A6

**Anchor(s) or adopted anchor:** BIO.A.4.1, BIO.A.4.2, BIO.A.4.3

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the structure and function of subcellular components and organelles
- Explain how subcellular components and organelles contribute to the function of the cell
- Describe the structural features of a cell that allow organisms to capture, store, and use energy
- Explain the effect of surface-area-to-volume ratios on the exchange of materials between cells or organisms and the environment
- Explain how specialized structures and strategies are used for efficient exchange of molecules to the environment
- Describe the role of each of the components of the cell membrane in maintaining the internal environment of a cell
- Describe the fluid mosaic model of cell membranes
- Explain how the structure of biological membranes influence selective permeability
- Describe the role of the cell wall in maintaining structure and function
- Describe the mechanisms by which organisms maintain solute and water balance
- Describe the mechanisms by which organisms move large molecules across the cell membrane
- Explain how the structure of a molecule affects its ability to pass through a plasma membrane
- Explain how concentration gradients affect the movement of molecules across a membrane
- Explain how osmoregulatory mechanisms contribute to the health and survival of organisms
- Describe the processes that allow ions to move across the cell membrane
- Describe the membrane bound structures of the eukaryotic cell and how they contribute to the compartmentalization of eukaryotic cell functions
- Describe similarities and differences in compartmentalization between prokaryotic and eukaryotic cells
- Describe the relationship between the functions of endosymbiotic organelles and their free-living ancestral counterparts

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- Cellular Organelle Worksheets
- One-Minute Essays on movement through cell membranes and active vs. passive transport
- Water Potential Calculations and Problem Sets
- AP Lab - Tonicity

**Extensions:**

- MyAP Classroom Question Bank
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on cellular organelles
- Teacher generated problems sets on Water Potential Calculations
- MyAP Classroom from College Board
- AP Biology Lab Manual from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework and problem sets
- Lab questions and reports
- Questioning during discussion

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Cellular Energetics

**Time frame:** 11 blocks

**State Standards:** 3.1.12.A2, 3.1.12.A5, 3.1.12.A7,

**Anchor(s) or adopted anchor:** BIO.A.2.3.1, BIO.A.2.3.2, BIO.A.3.1.1, BIO.A.3.2.1, BIO.A.3.2.2

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the properties of enzymes
- Explain how enzymes affect the rate of biological reactions
- Explain how changes to the structure of an enzyme might affect the function
- Explain how the cellular environment affects enzyme activity
- Describe the role of energy in living organisms
- Describe the photosynthetic processes that allow organisms to capture and store energy
- Explain how cells capture energy from light and transfer it to biological molecules for storage and use
- Describe the processes that allow organisms to use energy stored in biological macromolecules
- Explain how cells obtain energy from biological macromolecules in order to power cellular functions
- Explain the connection between variation and in the number and types of molecules within cells to the ability of the organism to survive and/or reproduce in different environments

**Core Activities:** Students will complete/participate in the following:

- Notes Outline
- Index Card Summaries
- One Minute Essays on enzyme structure and function / energy conversion in photosynthesis and respiration
- AP Lab - Cellular Respiration
- AP Lab - Photosynthesis
- Teacher Generated worksheets on the steps of photosynthesis and respiration

**Extensions:**

- Study Island
- Additional worksheets
- MyAP Classroom

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring



**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on Photosynthesis/ Respiration/ Enzymes
- MyAP Classroom from College Board
- AP Lab Manual from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Questioning during discussion
- Lab Questions and Reports

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Cell Communication and Cell Cycle

**Time frame:** 8 Blocks

**State Standards:** 3.1.12.A4, 3.1.12.A5, 3.1.12.B1

**Anchor(s) or adopted anchor:** BIO.B.1.1.1, BIO.B.1.1.2

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the ways that cells communicate with each other
- Explain how cells communicate with one another over short and long distances
- Describe the components of a signal transduction pathway
- Describe the role of the environment in eliciting a cell response
- Describe the different types of responses elicited by a signal transduction pathway
- Explain how a change in the structure of a signaling molecule affects the activity of the signaling pathway
- Describe positive and negative feedback mechanisms
- Explain how negative and positive feedback helps to maintain homeostasis
- Describe the events that occur in the cell cycle
- Explain how mitosis results in the transmission of chromosomes from one generation to another
- Describe the role of checkpoints in the regulation of the cell cycle
- Describe the effects of disruptions to the cell cycle on the cell and organism

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- One Minute Essays on a hormone vs. steroid signal transduction pathway and the cell cycle events
- AP Lab: Mitosis

**Extensions:**

- MyAP Classroom videos
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on signal transduction / positive and negative feedback / cell cycle regulation
- MyAP Classroom by College Board
- AP Lab Manual by College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework
- Questioning during lecture
- Lab questions and report

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Heredity

**Time frame:** 9 blocks

**State Standards:** 3.1.12.B1, 3.1.12.B2, 3.1.12.B3

**Anchor(s) or adopted anchor:** BIO.1.1.2, BIO.1.2.1, BIO.1.2.2, BIO.B.2.1.1, BIO.B.2.1.2

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain how meiosis results in the transmission of chromosomes from one generation to next
- Describe similarities and differences between the phases of mitosis and meiosis
- Explain how the process of meiosis generates genetic diversity
- Explain how shared, conserved, fundamental processes and features support the concept of common ancestry for all organisms
- Explain the inheritance of traits and genes as described by Mendel's laws
- Explain deviation from Mendel's model of inheritance of traits
- Explain how the same genotype can result in multiple phenotypes under different environmental conditions
- Explain how chromosomal inheritance generates genetic variation in sexual reproduction

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- Problem sets on monohybrid, dihybrid, incomplete dominance, codominance, and sex-linkage Punnet Square questions
- Pedigree Analysis
- Chi-square calculation problem sets
- AP Lab - Meiosis

**Extensions:**

- MyAP Classroom Videos
- Additional practice problems and worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on Punnett Square problems and Chi-Square problems
- MyAP Classroom from College Board
- AP Lab Manual from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework Problems on Punnett Squares and Chi-Square Calculations
- Questioning during discussion
- Lab questions and report

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Gene Expression and Regulation

**Time frame:** 13 blocks

**State Standards:** 3.1.12.A5, 3.1.12.B1, 3.1.12.B3, 3.1.12.B4

**Anchor(s) or adopted anchor:** BIO.2.2.1, BIO.2.2.2, BIO.2.3.1, BIO.2.4.1

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the structures involved in passing hereditary information from one generation to another
- Describe the characteristics of DNA that allow it to be used as hereditary material
- Describe the mechanisms by which genetic information is copied for transmission between generations
- Describe the mechanisms by which genetic information flows between DNA and RNA to protein
- Explain how the phenotype of organisms is determined by genotype
- Describe the types of interactions that regulate gene expression
- Explain how the location of regulatory sequences relates to their function
- Explain how the binding of transcription factors to promoter regions affects the gene expression and/or phenotype of an organism
- Explain the connection between regulation of gene expression and phenotypic differences in cells and organisms
- Describe the various types of mutation
- Explain how changes in genotype are seen as changes in phenotype
- Explain how alterations in DNA sequences contributes to variation that can be subject to natural selection
- Explain the use of genetic engineering techniques in analyzing or manipulating DNA

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- One minute essays on the role of RNA as enzymes in replication, transcription and translation
- Teacher Generated worksheets that practice DNA → RNA → Protein / Mutation
- AP Lab - Gel electrophoresis
- AP Lab - Transformation

**Extensions:**

- MyAP videos
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets practicing DNA → RNA → Protein and mutation
- MyAP Classroom from College Board
- AP Lab Manual from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework
- Student participation
- Lab questions and report
- Questioning during discussion

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Natural Selection

**Time frame:** 13 blocks

**State Standards:** 3.1.12.C1, 3.1.12.C2, 3.1.12.C3

**Anchor(s) or adopted anchor:** BIO.3.1.1, BIO.3.1.2, BIO.3.1.3, BIO.3.2.1, BIO.3.3.1

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the causes of natural selection
- Explain how natural selection affects populations
- Describe the importance of phenotypic variation in population
- Explain how humans can affect diversity in a population
- Explain the relationship between changes in the environment and changes in a population
- Explain how random occurrences affect the genetic makeup of a population
- Describe the change in genetic makeup of a population over time
- Describe the conditions under which genotype and allele frequencies will change in a population
- Explain the impacts on the population if any of the Hardy-Weinberg conditions are not met
- Explain how morphological, biochemical and geological data provide evidence that organisms have changed over time
- Describe the fundamental molecular and cellular features shared across all domains of life, which provide evidence for common ancestry
- Explain how evolution is an ongoing process for all living organisms
- Describe the types of evidence that can be used to infer an evolutionary relationship
- Explain how a phylogenetic tree or cladogram can be used to show evolutionary relatedness
- Describe the conditions under which new species can arise
- Describe the rate of speciation and evolution under different ecological conditions
- Explain the factors that drive extinction in populations
- Explain how species/genetic diversity in a population affects its ability to withstand environmental pressures
- Describe the scientific models that provide support to models of Earth's origins

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- One minute essays on speciation (both geographic and sympatric) / change in environment on rate of evolution
- Problem sets on Hardy-Weinberg calculations
- Teacher Generated worksheets on Cladogram analysis and construction
- Case Study on the Apple Maggot Fly and the Hawthorn Maggot Fly as well as other current examples of speciation



**Extensions:**

- MyAP Classroom videos
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets and problem sets
- MyAP Classroom from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework
- Student participation
- Questioning during discussion

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Ecology

**Time frame:** 13 blocks

**State Standards:** 3.1.12.C2, 3.1.12.A8

**Anchor(s) or adopted anchor:** BIO.4.1.1, BIO.4.1.2, BIO.4.2.1, BIO.4.2.2, BIO.4.2.3, BIO.4.2.4, BIO.4.2.5

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain the behavioral and/or physiological response of an organism related to changes in its external environment
- Explain how behavioral responses of organisms affect their overall fitness and may contribute to the overall success of the population
- Describe the strategies organisms use to acquire and use energy
- Explain how changes in energy availability affect populations and ecosystems
- Explain how the activities of autotrophs and heterotrophs enable the flow of energy in ecosystems
- Explain factors that influence growth of populations
- Explain how density of a population affects and it determined by resource availability
- Describe the structure of a community according to its species diversity
- Explain how community structure is related to energy availability in the environment
- Describe the relationship between species diversity and resilience to changes in the environment
- Explain how invasive species and humans affects the ecosystem dynamics

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Index Card Summaries
- One minute essays on energy flow through ecosystems / human impacts
- Teacher generated graphic organizer showing flow of energy and nutrients through the biosphere
- Case Study on invasive species

**Extensions:**

- MyAP Classroom videos
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Cooperative learning during labs
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on autotrophs / heterotrophs / decomposers
- MyAP Classroom from College Board

**Assessments:**

- Teacher generated quizzes
- Teacher generated tests
- Homework
- Student participation
- Questioning during discussion

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Anatomy & Physiology

**Time frame:** 2 blocks

**State Standards:** 3.1.12.A5

**Anchor(s) or adopted anchor:** BIO.A.4.1.1, BIO.4.1.2

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain how passive and active transport plays an important role in the action potential of a neuron
- Describe the different types of nervous communication in the body
- Describe the structure and function of cells specific to immunity in the body
- Explain the steps involved with the contraction of a muscle and how the active flow of calcium ions plays an important role

**Core Activities:** Students will complete/participate in the following:

- Note Outline
- Action Potential Diagram
- Index Card Summaries
- One Minute essay on the firing of a neurotransmitter from a presynaptic neuron

**Extensions:**

- MyAP Classroom videos
- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Group discussion
- Teacher modeling and visual aids
- Independent student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets
- MyAP Classroom from College Board

**Assessments:**

- Teacher generated quizzes
- Homework
- Student participation
- Questioning during discussion

## Curriculum Scope and Sequence

**Planned Course:** AP Biology

**Unit:** Conservation Biology and Restoration Ecology

**Time frame:** 2 blocks

**State Standards:** 3.1.12.A8

**Anchor(s) or adopted anchor:** BIO.A.4.1.1, BIO.A.4.1.2, BIO.4.2.1, BIO.4.2.2, BIO.4.2.3, BIO.4.2.4, BIO.4.2.5

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe how human activities are threatening Earth's biodiversity
- Describe how regional and landscape conservation can sustain biomes
- List the possible steps that restoration ecology takes to restore degraded ecosystems to a natural state
- Explain how sustainable development seeks to improve the human condition while conserving biodiversity

**Core Activities:** Students will complete/participate in the following:

- Notes Outline
- Index Card Summaries
- Presentations on current examples of restoration projects in our area
- Case studies from textbook to analyze best practices

**Extensions:**

- Additional worksheets

**Remediation:**

- Study Island
- Review worksheets
- Peer tutoring

**Instructional Methods:**

- Direct instruction using notes and key terms
- Group discussion
- Teacher modeling and visual aids
- Independent/collaborative student work

**Materials & Resources:**

- Textbook
- Teacher generated worksheets on organic farming / hydroponics / monoculture

**Assessments:**

- Teacher generated quizzes
- Homework
- Student participation
- Questioning during discussion