FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

MEDICAL SCIENCES SPECIALIZED LEARNING CENTER

ADVANCED PLACEMENT BIOLOGY

COURSE PHILOSOPHY

Medical Sciences A.P. Biology looks to provide students with a solid and thorough foundation in core biological principles to both foster further studies in the learning center and empower students to see how decisions they make affect themselves and others in our society. Throughout the course, critical issues such as genetic engineering, evolution, human impact on the environment, and cellular energy are stressed. Units of study are designed to promote scientific thinking and problem solving to develop an awareness of the practical applications of their knowledge.

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COURSE DESCRIPTION

Medical Sciences A.P. Biology provides an understanding of the unifying themes and fundamental concepts and principles of biology with an emphasis on inquiry and critical thinking skills including problem solving, mathematical reasoning, and experimental investigations. Topics of study include molecules and cells, heredity and evolution, and organisms and populations. Laboratory work is an integral component of this introductory, accelerated course. Teaching strategies include in depth laboratory investigations, demonstrations, collaborative peer-to-peer discussions, and student hands-on experiences. Practical application of concepts to current trends in medicine and bioethics is also explored. Utilization of technology to conduct scientific investigations includes internet and online resources, spreadsheets, and presentation software, as well as the experimental apparatus of biology.

Grade Level: 9

Department: Medical Sciences Specialized Learning Center

Course Title: Advanced Placement Biology

Credits: 5

Course Code: 161440

BOARD OF EDUCATION ADOPTION DATE: AUGUST 31, 2009

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Course Philosophy

Medical Sciences A.P. Biology looks to provide students with a solid and thorough foundation in core biological principles to both foster further studies in the learning center and empower students to see how decisions they make affect themselves and others in our society. Throughout the course, critical issues such as genetic engineering, evolution, human impact on the environment, and cellular energy are stressed. Units of study are designed to promote scientific thinking and problem solving to develop an awareness of the practical applications of their knowledge

Course Description

Medical Sciences A.P. Biology provides an understanding of the unifying themes and fundamental concepts and principles of biology with an emphasis on inquiry and critical thinking skills including problem solving, mathematical reasoning, and experimental investigations. Topics of study include molecules and cells, heredity and evolution, and organisms and populations. Laboratory work is an integral component of this introductory, accelerated course. Teaching strategies include in depth laboratory investigations, demonstrations, collaborative peer-to-peer discussions, and student hands-on experiences. Practical application of concepts to current trends in medicine and bioethics is also explored. Utilization of technology to conduct scientific investigations includes internet and online resources, spreadsheets, and presentation software, as well as the experimental apparatus of biology.

Freehold Regional High School District
Curriculum Map

Medical Sciences Advanced Placement Biology

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1. A1-4, C 5.2. B.1-3 5.5. A1	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Safe and appropriate use of instruments will result in a clearer understanding of experimental results. There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems	Why is safety essential for successful laboratory investigation? To what extent do valuable test results depend on accurate and precise laboratory skills? Why is a controlled experiment essential in obtaining significant results in a scientific investigation? Why is it important to use reasoning and logic when interpreting facts? Why is it important to communicate findings? How does scientific knowledge advance and build upon previous discoveries using the scientific method of problem solving? Why must all organisms exhibit every characteristic of life? How are unique bonding properties of atoms responsible for creating molecules integral to life's processes? How do the unique chemical and physical properties of water make life on earth possible? How does the structure of an atom contribute to its biological properties and bonding patterns? How is the role of carbon important in the molecular diversity of life? How do the structures of biologically important molecules (carbohydrates, proteins, lipids and nucleic acids) account for their functions? How do cells synthesize and catabolize macromolecules?	Pretest Student Survey Oral Questions/ Discussion Anticipatory Set Questions	Homework Quizzes Class discussion Graphic organizers Cooperative learning activities Analysis/Synthesis open-ended questions (written and or oral responses)	Tests Quizzes Unit Exams Lab Reports Projects Essays
5.1 A1-4, B.1, C 5.2 B1-3 5.3 A-D 5.5 A1	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. The cell is the basic unit of life. Living cells are composed	How the similarities and differences between prokaryotes and eukaryotes relate to their function? How are their evolutionary relationships reflected in their similarities and differences? How does compartmentalization organize a cells function?			

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
	of elements that form large, complex molecules. There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.	How are the structures of the various sub cellular organelles related to their functions? How do organelles function together in cellular processes? Why must a cells size be limited? How do variations in the structure of membranes account for functional differences? How does the structural organization of membranes provide for transport and recognition? To what extent is the mechanism by which substances cross membranes? How does membrane transport relate to various physiological homeostatic mechanisms (immunity, muscle contraction, action potential)?			
5.1. A1-4, C 5.2 B1-3 5.3 A-D 5.5 A1-3 5.10 A1, B1-2	There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Matter reacts and that various factors can affect the rates and outcomes of different chemical reactions. Energy is the capacity to do work. All living organisms are active (living) because of their abilities to link energy reactions to the biochemical	How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems? 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? Why is ATP important in a cell's anabolic and catabolic reactions? How does chemiosmosis function in bioenergetics? How are organic molecules broken down by catabolic pathways? Why is oxygen important in energy yielding pathways? How do cells generate ATP in the absence of oxygen? 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 kind of photosynthetic adaptations have evolved in response to			

Relevant Standards 1	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
	reactions that take place within their cells. Living organisms are interdependent and rarely exist alone in nature. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. Human activities impact the cycling of matter and flow of energy through ecosystems.	different environmental conditions? What interactions exist between photosynthesis and cellular respiration?			
	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution.	How does the process of meiosis relate to sexual reproduction? Why is meiosis important in heredity? How is meiosis related to gametogenesis? How does gametogenesis in animals compare to the process in plants, fungi, and protists? How is genetic information organized in eukaryotic chromosomes? How does chromosome structure contribute to both the continuity of and variability in genetic information? How did Mendel's work lay the foundation for modern genetics? How do the principle patterns of inheritance function? How do the structures of nucleic acids relate to their functions of information storage and protein synthesis? How do viruses transmit genetic information to host cells? How are prokaryotic genomes and eukaryotic genomes alike and how are they different?			

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
	There are predictable patterns of inheritance. Asexual reproduction produces offspring that have the same genetic code as the parent and leads to less variation in a species. Sexual reproduction produces offspring with a mixture of DNA increasing the genetic variation of an organism, and therefore, the species. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.	How do prokaryotes and eukaryotes regulate the mechanisms of gene expression? To what extent can genetic information be altered? How does genetic engineering contribute to our knowledge of DNA structure and function? How do the principles of inheritance and molecular regulation relate to disease and pathology?			
5.1 A1-4, B1-2, C 5.2 A.1, B1-3 5.3 A-D 5.4 A.1 5.5 B1-2 5.10 A.1	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Evolution is the foundation of modern biological models. Evolution is the biological change of organisms that occurs over time and is driven by the process of natural selection. Evolution accounts for the diversity of life on Earth. All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to	How are current biological models used to explain the origins of biological macromolecules? How do current models explain the origins of prokaryotic and eukaryotic cells? To what extent is the evidence that supports the evolutionary view of life? Why is natural selection integral in the process of evolution? How are heredity and natural selection involved in the process of evolution? To what extent are the mechanisms involved in speciation and macroevolution?			

Relevant Standards 1	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
	change over time, or evolution. There are multiple theories that explain how organisms have changed over time. Living organisms are interdependent and rarely exist alone in nature. There are forces in the earth that affect its structure, dynamics and geographical systems. There are naturally occurring phenomena that affect the environment. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.				
5.1 B1-2, C 5.2 A.1 5.3.A-D 5.4 A.1, B.1 5.10 A.1, B1-2	Living organisms are interdependent and rarely exist alone in nature. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. The environment as a system of interdependent components affected by human activity and natural phenomena. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.	How can abiotic and biotic dynamics influence population growth? To what extent to variations in life history strategies affect population growth and interspecific/intrascpefic competition? How is energy flow through ecosystems related to trophic structures? How do elements (C,H,O,N,P,S) cycle through ecosystems? How do organisms affect the cycling of elements and water through biosphere? How do biotic and abiotic factors affect competition, community structure, and ecosystem functions? How are humans affecting biogeochemical cycles?			

Relevant Standards 1	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
	Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.				
5.1 B1-2, C 5.2 A.1 5.3.A-D 5.5 A.4, B1-2 5.10 B.2	Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.	How are organisms classified? How are the representative members of archaebacteria, eubacteria, protista, fungi, plants and animals further classified? How are patterns of reproduction and development regulated in plants and animals? How do scientists study evolutionary relationships among organisms? How is this information used in the classification of organisms? Why is alternation of generation an adaptive significance in plants? To what extent do the major body plans of plants and animals exhibit evolutionary patterns? How does the organization of cells and tissues and organs determine structure and function in plants and animals? How are structure and function related in the various organ systems? How do organ systems of animals interact? To what extent have plants and animals adapted to contribute to their success on land?			

Freehold Regional High School District
Course Proficiencies and Pacing

Medical Sciences Advanced Placement Biology

Unit Title	Unit Understandings and Goals	Duration
Unit #1: Nature of Science and Biochemistry	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Safe and appropriate use of instruments will result in a clearer understanding of experimental results. There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. *Students will:* • Understand and adhere to the safety rules in the laboratory. • Describe the basic characteristics of all living organisms. • Demonstrate an understanding of atomic number, atomic mass units, and the fundamentals of the periodic table. • Demonstrate familiarity with models of atomic structure and how they were developed. • Understand what an isotope is and explain how some are used in research and in dating rock samples. • Understand the formation and importance of biologically significant ions. • Understand the fundamentals of various types of bonding as well as biologically significant examples • Demonstrate an understanding the special bonding properties of polar covalent molecules including how these bonds are formed. • Demonstrate an understanding of the significance of water to metabolism, living organisms, and biogeochemical cycling. • Demonstrate knowledge of the solute-solvent relationship. • Understand fundamentals of acid/base theory. • Identify organic compounds as carbon compounds and explain why they can be so complex. • Identify the structure and functions of carbohydrates, lipids, proteins and nucleic acids in organisms.	4 weeks
Unit #2: Cytology	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. The cell is the basic unit of life. Living cells are composed of elements that form large, complex molecules. There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. *Students will:* • List the contributions made in the development of the cell theory. • Differentiate between prokaryotic and eukaryotic cells. • Distinguish between unicellular and multicellular organisms. • Understand the types of microscopy used to explore cell ultrastructure. • Understand the relationship between cell volume and surface area. • Demonstrate thorough knowledge of the following organelles: cell membrane, cell wall, nucleus, nucleolus, smooth and rough endoplasmic reticulum, ribosomes, golgi complex, lysosomes, chloroplasts, mitochondria, cytoskeleton, cilia & flagella. • Cite and explain the evidence supporting the symbiosis model of the origin of eukaryotic cells.	4 weeks

Unit Title	Unit Understandings and Goals	Duration
	• Successfully observe specimens under microscope and complete laboratory inquires. • Recognize that random motion of individual molecules is responsible for diffusion. • Understand simple diffusion through a semi permeable membrane in terms of the concentration of molecules and ions in evaluating a concentration gradient. • Deduce the direction of ion/molecular movement according to concentration gradient. • Understand the concepts of osmosis and diffusion and apply to problem solving. • Relate osmosis and diffusion to events occurring within and around the cell including the plasma membrane and organelles. • Understand and summarize processes of active transport vs. passive transport. • Describe passive and active filtration through the nephron. • Relate action potential and neurotransmitter release/reuptake in neurons to cellular transport mechanisms. • Explain how sliding filament theory of muscle contraction embodies cellular transport mechanisms and cell physiology to maintain a negative homeostatic feedback mechanism. • Relate cell physiology and transport mechanisms to nonspecific and specific/primary and secondary immune responses. • Relate physiological failure of immune response to disease and allergies.	
Unit #3: Thermodynamics and Energy Cycling	There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Matter reacts and that various factors can affect the rates and outcomes of different chemical reactions. Energy is the capacity to do work. All living organisms are active (living) because of their abilities to link energy reactions to the biochemical reactions that take place within their cells. Living organisms are interdependent and rarely exist alone in nature. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. Human activities impact the cycling of matter and flow of energy through ecosystems. *Students will:* • Recognize that enzymes function as organic catalysts by lowering the activation energy of the reaction. • Recognize that enzymes are unchanged and can be recovered/recycled after the reaction is complete. • Recognize the specificity of enzymes and understand the "lock and key" and "induced fit" theories of enzyme-substrate reaction. • Recognize the existence of enzyme systems and feedback mechanisms that demonstrate the negative feedback homeostatic control mechanisms. • Understand the relationship of physical or environmental influence factors on the optimum rate of enzyme action; temperature pH, concentration of enzymes, and concentration of substrate. • Understand the chemical factors in the environment of the enzyme may influence the rate of reaction; inhibitors and activators. Relate the presence of coenzymes to the health of the organisms. • Understand that the energy gained via glycolysis is sufficient to form four ATP from four ADP, but two ATP are utilized – therefore – the net gain is two ATP. • Recognize that anaerobic respiration in bacteria and yeast results in two carbon dioxide molecules as well as two ethyl alcohol molecules. • Understand that the lactic acid cycle in human muscle results from oxygen debt.	5 weeks

Unit Title	Unit Understandings and Goals	Duration
	• Understand the role of the mitochondrion in aerobic respiration. • Demonstrate a basic understanding of the Kreb Cycle; citric acid formation, how carbon dioxide is generated, and the role of NAD^+, NADH, FAD^+, FADH. • Gain an understanding of the electron transport chain (oxidation – reduction) and hydrogen ion concentration across the mitochondrial membrane. • Recognize that chemiosmosis is the basic method of ATP production. • Recognize that much of the expired carbon dioxide comes from the Kreb Cycle; the water from the oxygen inspired and combined ultimately with the hydrogen from the glucose. • Summarize how energy is captured from sunlight in the light dependent reactions of photosynthesis. • Analyze the function of the electron transport chain in light dependent reactions of photosynthesis. • Describe factors influencing noncyclic and cyclic electron transport. • Describe how plants (*and other organisms*) produce substances high in energy content that become the primary source of energy for life. • Compare plant adaptations of C_3, C_4, and CAM photosynthesis • Identify three environmental factors that affect the rate of photosynthesis. • Describe the cyclic relationship between photosynthesis and cellular respiration (energy and carbon cycling).	
Unit #4: Genetics	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution. There are predictable patterns of inheritance. Asexual reproduction produces offspring that have the same genetic code as the parent and leads to less variation in a species. Sexual reproduction produces offspring with a mixture of DNA increasing the genetic variation of an organism, and therefore, the species. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. *Students will:* • Relate the study of genetics to the processes of mitosis and meiosis, DNA structure and function, and protein synthesis. • Describe how homologous chromosomes follow Mendel's laws as well as potential exceptions. • Apply probability to Mendelian genetics problems to develop genotypic and phenotypic ratios. • Demonstrate the ability to recognize and genotype individuals in pedigrees involving exceptions to Mendels laws. Solve problems involving exceptions to Mendels laws such as, codominance and incomplete dominance, multiple alleles, sex-linked inheritance, polygenic traits, and epistatic alleles. • Chronicle the classic experiments, techniques, and logic leading to the discovery of DNA as the genetic material. • Recognize the structural and functional differences between DNA and RNA. • Describe the role of enzymes in the replication and regulation of DNA. • Understand how the gene is transcribed and translated. • Understand how t-RNA "wobble" can contribute to mutations and evolution.	5 weeks

Unit Title	Unit Understandings and Goals	Duration
	• Understand the complementary relationships of DNA, m-RNA, and t-RNA. • Relate the production of particular polypeptide to certain generic characteristics of the cell and ultimately the organism itself. • Apply process skills to solve problems involving the genetic code. • Describe processes used by viruses to copy and transmit genetic information. • Describe the basic functioning of operons in the prokaryotic chromosome. • Describe the role of plasmids in bacterial conjugation and their role in variation. • Describe major differences between prokaryotic and eukaryotic chromosomes. • Relate the role of histones, nucleosomes, and looped domains in eukaryotic gene expression. • Describe 3 major classes of eukaryotic DNA- give an example of each. • Describe eukaryotic gene regulation including pre-transcription (enhancers), post-transciption, pre-translation, and post-translation processes. • Recognize mutation as a mechanism of natural selection. • Recognize the techniques used in DNA manipulation such as cloning, gene splicing, and recombinant DNA. • Demonstrate knowledge of and familiarity of lab techniques (RFLP, transformation, and PCR).	
Unit #5: Evolution and Speciation	Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing. Evolution is the foundation of modern biological models. Evolution is the biological change of organisms that occurs over time and is driven by the process of natural selection. Evolution accounts for the diversity of life on Earth. All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution. There are multiple theories that explain how organisms have changed over time. Living organisms are interdependent and rarely exist alone in nature. There are forces in the earth that affect its structure, dynamics and geographical systems. There are naturally occurring phenomena that affect the environment. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole. *Students will:* • Explain the steps leading to the evolution of the first cells. Demonstrate familiarity with the current theories regarding energy use by the first cells. • Locate the possible origins of large taxonomic groups. • Understand the ideas of evolution by natural selection as stated by Darwin and Wallace. • Identify the main inferences of natural selection. • Recognize natural selection as mechanism of adaptive evolution. • Recognize evolutionary fitness as the contribution of individual to gene pool of next generation. • Comprehend common misconceptions associated with natural selection and adaptation. • Understands environment's role in evolution. • Recognize the difference between gradualism and punctuated equilibrium stated by Gould. • Understand the concept of a gene pool whereas all genes are available to all other members of the species. • Understands how genetic variation occurs within and between species. • Understands how mutation and sexual recombination contributes to genetic variation. • Understands how diploidy and balanced polymorphism preserve variation.	3 weeks

Unit Title	Unit Understandings and Goals	Duration
	• Understands principle of Hardy-Weinberg and is able to perform and interpret quotients. • Understand how evolution operates in isolated environments. • Understands modes of speciation. • Recognize the effect of selection on a varying characteristic can be convergent, stabilizing, directional, or diversifying. • Recognize sexual selection may lead to pronounce secondary differences between the sexes. • Understand the mechanisms of adaptive radiation. • Understand what the fossil record indicates about the progression of life on earth. • Understand the evidences that support evolution: fossils, homology, comparative anatomy, comparative embryology, and comparative biochemistry (amino acid sequence similarity). • Interpret the phrase "imperfection of natural selection." • Explain how the theory of natural selection accounts for extinction as well as an increase in the proportion of individuals with advantageous characteristics within a species.	
Unit #6: Ecology	Living organisms are interdependent and rarely exist alone in nature. Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. The environment as a system of interdependent components affected by human activity and natural phenomena. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole. *Students will:* • Define ecology and appreciate its importance as a major area of biological science. • Demonstrate as understanding of the properties of populations and factors that influence their growth. • Explain how current human population growth is unique when compared with other mammals. • Demonstrate knowledge of and apply examples of Gause's principle of competitive exclusion. • Describe and understand ecological, fundamental, and realized niche. • Understand and apply knowledge of the predator/prey relationship to evaluate sample populations. • Understand the relationship between species diversity and predation. • Demonstrate the ability to understand the following concepts regarding predator/prey co-evolution, natural plant defenses, natural defenses in animals, concealment and camouflage, timing, obnoxious defenses, and mimicry. • Understand symbiosis: predation, parasitism, mutualism, and commensalism. • Understand the flow of energy through various ecosystems. • Evaluate the role of producers, consumers and detrivores (decomposers). • Explain the factors that affect the "energy pyramid". • Apply the concept of ecological succession in evaluating various types of ecosystems. • Understand the fundamentals of earth science relating to climate, wind, and weather. • Understand the characteristics of the following types of environments and the life forms they support: rivers & streams, lakes and ponds, oceans and seashores. • Understand and apply the concept of the biome in evaluating geographical areas.	4 weeks

Unit Title	Unit Understandings and Goals	Duration
	• Understand the importance of human responsibility to protect important biomes such as the tropical rain forest to prevent mass extinctions and control the ever increasing greenhouse effect. • Assess the impacts of introducing a new technology in terms of alternative solutions, costs, tradeoffs, risks, benefits and environmental impact.	
Unit #7: Classification and Organismal Biology	Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems. Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms. Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole. • Understand principles of taxonomy and systematics of the kingdom and domain systems of classification. • Understand characteristic features of each of the kingdoms, including morphology, reproductive patterns, and adaptations. • Understand role bacteria play in pathology. • Understand beneficial and harmful role or protists and fungi. • Compare anatomy and physiology across major plant divisions of systems and tissues responsible for the following: transport/circulation, reproduction, gas exchange, defense, and storage of nutrients. • Understand characteristic features of Kingdom Animalia including applications to individual phyla such as pseudocoelomate, coelomate, protostome, and deuterostome. • Demonstrate familiarity with general morphology, physiology, habitats, and reproduction of following animal phyla: porifera, cnidaria, platyhelminthes, rhynchoceola, nematoda, mollusca, annelida, arthropoda, echinodermata, chordate. • Relate the structure and function of tissues, organs, and systems to homeostatic mechanisms and the immune response. • Compare anatomy and physiology across major animal phyla of the following organs/organ systems: circulation, respiration (gas exchange), reproduction, processing of external stimuli (nervous system), digestion, and excretion. • Relate disease in humans and other organisms to infections or intrinsic failures of system.	9 weeks

Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #1: Nature of Science and Biochemistry

Enduring Understandings: Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.
Safe and appropriate use of instruments will result in a clearer understanding of experimental results.
There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism.
Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.

Essential Questions: Why is safety essential for successful laboratory investigation?
To what extent do valuable test results depend on accurate and precise laboratory skills?
Why is a controlled experiment essential in obtaining significant results in a scientific investigation?
Why is it important to use reasoning and logic when interpreting facts?
Why is it important to communicate findings?
How does scientific knowledge advance and build upon previous discoveries using the scientific method of problem solving.
Why must all organisms exhibit every characteristic of life?
How are unique bonding properties of atoms responsible for creating molecules integral to life's processes?
How do the unique chemical and physical properties of water make life on earth possible?
How does the structure of an atom contribute to its biological properties and bonding patterns?
How is the role of carbon important in the molecular diversity of life?
How do the structures of biologically important molecules (carbohydrates, proteins, lipids and nucleic acids) account for their functions?
How do cells synthesize and catabolize macromolecules?

Unit Goal: Understand and adhere to the safety rules in the laboratory.
Duration of Unit: 4 weeks
NJCCCS: 5.1.A1-4, 5.1.C; 5.2.B1-3; 5.5.A1

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How does the Scientific Method serve to explain and objectively analyze natural phenomena? Why is safety and proper laboratory protocol important to scientific investigation? How does modern atomic theory explain the behavior of biologically-important elements?	Review the fundamentals of the periodic table. Discuss models of atomic structure and how they were developed. Discuss the formation and importance of biologically significant ions. Explore the fundamentals of various types of bonding as well as biologically significant examples.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence	Written tests and quizzes Critical thinking questions Project assessments Article reviews Lab reports and analyses Responses to discussion questions

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How does bonding relate to the structure and function of organisms? Why is water a biologically-significant molecule? How might variations in pH impact living organisms? What characteristics do all biomolecules share to form the foundation of cells and living organisms?	Describe bonding properties of polar covalent molecules including how these bonds are formed. Relate significance of water to metabolism, living organisms, and biogeochemical cycling. Demonstrate knowledge of the solute-solvent relationship. Understand fundamentals of acid/base theory. Identify organic compounds as carbon compounds and explain why they can be so complex. Identify the structure and functions of carbohydrates, lipids, proteins and nucleic acids in organisms.		Models/manipulatives to create and recognize distinguishing characteristics (elements and bonding patterns) of biological macromolecules Graphic Organizers to represent distinguishing characteristics of water and characteristics of organic macromolecules	

Suggestions on how to differentiate in this unit:

Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods.

A wide variety of assessments and strategies complement the individual learning experience.

Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #2: Cytology

Enduring Understandings: Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.
The cell is the basic unit of life. Living cells are composed of elements that form large, complex molecules.
There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism.
Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.

Essential Questions: How the similarities and differences between prokaryotes and eukaryotes relate to their function?
How are their evolutionary relationships reflected in their similarities and differences?
How does compartmentalization organize a cells function?
How are the structures of the various subcellular organelles related to their functions?
How do organelles function together in cellular processes.
Why must a cells size be limited?
How do variations in the structure of membranes account for functional differences?
How does the structural organization of membranes provide for transport and recognition?
To what extent is the mechanism by which substances cross membranes?
How does membrane transport relate to various physiological homeostatic mechanisms (immunity, muscle contraction, action potential)?

Unit Goal: List the contributions made in the development of the cell theory.
Duration of Unit: 4 weeks
NJCCCS: 5.1.A1-4, 5.1.B.1, 5.1.C; 5.2.B1-3; 5.3.A-D, 5.5.A1

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What scientific events and discoveries led up to the development of Cell Theory? What advances in technology contributed to Cell Theory? What additional advances have enhanced our current understanding of cytology? How does cell size and structural characteristics contribute to the theme of structure vs. function? What factors determine how molecules move across a semi-permeable cell membrane?	Review the development of the cell theory. Differentiate between prokaryotic and eukaryotic cells; unicellular and multicellular organisms. Introduce the types of microscopy used to explore cell ultrastructure. Describe the relationship between cell volume and surface area. Review function and characteristics of cellular structures/organelles. Explain the evidence supporting the symbiosis model of the origin of eukaryotic cells.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence Microscopy lab(s): overview of various cell types; distinguish organelles/cell structures and basic microscopy skills Class jigsaw for cell structures/organelles	Written tests and quizzes Critical thinking Project assessments Article reviews Lab reports and analyses including **A.P. Lab #1: Diffusion and Osmosis**

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
				Responses to discussion questions
	Describe the subcellular structures that comprise the plasma membrane. Observe specimens under microscope and complete laboratory inquires. Discuss simple diffusion in terms of the concentration of molecules and ions in evaluating a concentration gradient. Predict the diffusion of particles through a semi permeable membrane. Relate osmosis and diffusion to events occurring within and around the cell including the plasma membrane and organelles. Summarize processes of active transport vs. passive transport. Relate passive/active transport to physiology and homeostatic mechanisms of nephron, neuron, muscle contraction, and immune response.		Cell transport lab with dialysis tubing and varying tonicity (or equivalent for A.P. exam prep) Class role play of various transport processes across plasma membrane (http://www.accessexcellence.com/AE/ATG/) Graphic Organizers: • Compare/Contrast diagrams (e.g., Venn) of prokaryotic vs. eukaryotic cells; multicellular organisms vs. unicellular organisms; plant cell vs. animal cell; active vs. passive transport processes • Table comparing cell structures (Prok/Euk – Plant/Animal). Diagram of plasma membrane detailing all membrane components as well as an example of each type of transport and relevant concentration gradients	

Suggestions on how to differentiate in this unit:
Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods.
A wide variety of assessments and strategies complement the individual learning experience.

Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #3: Thermodynamics and Energy Cycling

Enduring Understandings: There is a relationship between the structure of inorganic and organic molecules to their function in cellular structure and metabolism.
Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
Matter reacts and that various factors can affect the rates and outcomes of different chemical reactions.
Energy is the capacity to do work. All living organisms are active (living) because of their abilities to link energy reactions to the biochemical reactions that take place within their cells.
Living organisms are interdependent and rarely exist alone in nature.
Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.
Human activities impact the cycling of matter and flow of energy through ecosystems.

Essential Questions: How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
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?
Why is ATP important in a cell's anabolic and catabolic reactions?
How does chemiosmosis function in bioenergetics?
How are organic molecules broken down by catabolic pathways?
Why is oxygen important in energy yielding pathways?
How do cells generate ATP in the absence of oxygen?
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 kind of photosynthetic adaptations have evolved in response to different environmental conditions?
What interactions exist between photosynthesis and cellular respiration?

Unit Goal: Students will recognize that enzymes function as organic catalysts by lowering the activation energy of the reaction.
Duration of Unit: 5 weeks
NJCCCS: 5.1.A1-4, 5.1.C; 5.2.B1-3; 5.3.A-D; 5.5.A1-3; 5.10.A1, 5.10.B1-2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do enzymes speed-up and regulate chemical reactions? How do enzymes work to maintain homeostasis in organisms? How are enzymes regulated?	Explore examples of enzyme feedback systems as homeostatic control mechanisms. Describe factors that affect enzyme functioning. Discuss processes of glycolysis, oxidative respiration and fermentation, including products, reactants, cellular structures involved.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence Catabolism laboratory (or equivalent for A.P. exam prep)	Written tests and quizzes Lab report and analysis including **A.P. lab #2: Enzymes and Catalysis** Critical thinking questions

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
				Project assessments Article reviews
How is solar energy transformed to chemical energy by producers? How do consumers and producers utilize energy created by photosynthesis and chemosynthesis to maintain homeostasis? Explain how/why monosaccherides are converted to ATP by cells.	Explain process of chemiosmosis in ATP production. Summarize how energy is captured from sunlight in the light dependent reactions of photosynthesis and products used in Calvin Cycle. Review purpose and relevance of noncyclic and cyclic electron transport. Compare plant adaptations of C_3, C_4, and CAM photosynthesis. Discuss environmental factors affecting rate of photosynthesis. Relate photosynthesis and cellular respiration to trophic interactions and energy cycling. Discuss human impact on carbon and energy cycling due to population growth and consumption of nonrenewable resources/deforestation.		Cellular respiration lab comparing rate of respiration/oxygen demand at various temperatures (or equivalent for A.P. exam prep) Photosynthesis lab evaluating chloroplast photosynthetic activity under varying conditions via spectrophotometer analysis (or equivalent for A.P. exam prep) Role play of any of the following processes: Glycolysis Aerobic respiration Light-dependent reactions of photosynthesis Graphic organizers ▪ Visual analogies for enzyme feedback mechanisms ▪ Flow diagrams reactions of photosynthesis, cellular respiration ▪ Comparison diagrams of photosynthesis vs. cellular respiration; anaerobic vs. aerobic respiration; C_3, C_4, and CAM photosynthesis	Lab reports and analyses including **A.P. labs #4 and #5 (Plant Pigments and Photosynthesis and Cell Respiration)** Responses to discussion questions

<u>Suggestions on how to differentiate in this unit</u>:
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Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #4: Genetics

Enduring Understandings:
Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.
Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.
Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution.
There are predictable patterns of inheritance. Asexual reproduction produces offspring that have the same genetic code as the parent and leads to less variation in a species.
Sexual reproduction produces offspring with a mixture of DNA increasing the genetic variation of an organism, and therefore, the species.
Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.

Essential Questions:
How does the process of meiosis relate to sexual reproduction?
Why is meiosis important in heredity?
How is meiosis related to gametogenesis?
How does gametogenesis in animals compare to the process in plants, fungi, and protists?
How is genetic information organized in eukaryotic chromosomes?
How does chromosome structure contribute to both the continuity of and variability in genetic information?
How did Mendel's work lay the foundation for modern genetics?
How do the principle patterns of inheritance function?
How do the structures of nucleic acids relate to their functions of information storage and protein synthesis?
How do viruses transmit genetic information to host cells?
How are prokaryotic genomes and eukaryotic genomes alike and how are they different?
How do prokaryotes and eukaryotes regulate the mechanisms of gene expression?
To what extent can genetic information be altered?
How does genetic engineering contribute to our knowledge of DNA structure and function?
How do the principles of inheritance and molecular regulation relate to disease and pathology?

Unit Goal: Students will relate the study of genetics to the processes of mitosis and meiosis, DNA structure and function, and protein synthesis.
Duration of Unit: 5 weeks
NJCCCS: 5.1.A1-4, 5.1.B1-2, 5.1.C; 5.2.A.1, 5.2.B1-3; 5.3.A-D; 5.4.A.1; 5.5.A4, 5.5,C1-3; 5.10.B2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Why is meiosis a mechanism for Mendel's Laws of Inheritance? How can we use probability to analyze genetic inheritance patterns? What are the limitations? Why are nucleic acids suitable macromolecules for carrying the genetic code of organisms? How does gene regulation and inheritance differ for prokaryotic and eukaryotic organisms? How is mutation a mechanism of natural selection? How can we study and use viral and prokaryotic genetic mechanism to better understand eukaryotic gene regulation and gene technologies? How do emerging genetic technologies and procedures impact our society (culturally, ethically, economically)? How do patterns of genetic inheritance complement Darwin's Theory of Natural Selection?	Relate the study of genetics to the processes of mitosis and meiosis, DNA structure and function, and protein synthesis. Describe how homologous chromosomes follow Mendel's laws as well as potential exceptions. Apply probability to Mendelian genetics problems to develop genotypic and phenotypic ratios. Demonstrate the ability to recognize and genotype individuals in pedigrees involving exceptions to Mendels laws. Solve problems involving exceptions to Mendels laws. Chronicle the classic experiments leading to the discovery of DNA as the genetic material. Recognize the structural and functional differences between DNA and RNA. Describe the role of enzymes in the replication and regulation of DNA. Describe how the gene is transcribed and translated. How can contribute to mutations and evolution. Relate the production of particular polypeptide to certain generic characteristics of the cell and ultimately the organism itself. Describe processes used by viruses to copy and transmit genetic information and basic functioning of operons in the prokaryotic chromosome. Describe the role of plasmids in bacterial conjugation and their role in variation. Describe major differences between prokaryotic and eukaryotic chromosomes. Describe eukaryotic gene regulation. Demonstrate knowledge of and familiarity of lab techniques (RFLP, transformation, etc) and methods of DNA manipulation.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence. Lab investigations ▪ mitosis/meiosis with manipulatives and microscopy (A.P. lab or the equivalent) ▪ Mendel's laws using *Drosophila* or fast plants (A.P. lab or the equivalent) ▪ transformation with bacterial plasmids using E. coli (A.P. lab or the equivalent) ▪ RFLP via electrophoresis (A.P. lab or the equivalent) Cooperative Learning/Experimentation and Analysis ▪ Jigsaw of scientific investigations leading to understanding of DNA structure and function ▪ 3-dimensional model of DNA. ▪ Ethical debate and role play Graphic Organizers (comparison of): ▪ exceptions to Mendel's laws ▪ DNA vs. RNA ▪ mRNA/tRNA/rRNA ▪ eukaryotic vs. prokaryotic gene expression ▪ genetic engineering technologies	Written tests and quizzes Critical thinking questions Project assessments Article reviews Lab reports and analyses **A.P. lab #3 Mitosis and Meiosis** **A.P. lab #6 Molecular Biology and Transformation** **A.P. lab #7 Genetics of Organisms (genetics crosses)** Responses to discussion questions

<u>Suggestions on how to differentiate in this unit</u>:

Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods.

A wide variety of assessments and strategies complement the individual learning experience.

Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #5: Evolution and Speciation

Enduring Understandings: Science is a way of knowing. It can involve a discovery process using inductive reasoning, or it can be a process of hypothesis testing.
Evolution is the foundation of modern biological models.
Evolution is the biological change of organisms that occurs over time and is driven by the process of natural selection. Evolution accounts for the diversity of life on Earth.
All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to change over time, or evolution.
There are multiple theories that explain how organisms have changed over time.
Living organisms are interdependent and rarely exist alone in nature.
There are forces in the earth that affect its structure, dynamics and geographical systems. There are naturally occurring phenomena that affect the environment.
Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.

Essential Questions: How are current biological models used to explain the origins of biological macromolecules?
How do current models explain the origins of prokaryotic and eukaryotic cells?
To what extent is the evidence that supports the evolutionary view of life?
Why is natural selection integral in the process of evolution?
How are heredity and natural selection involved in the process of evolution.
To what extent are the mechanisms involved in speciation and macroevolution?

Unit Goal: Explain the steps leading to the evolution of the first cells. Demonstrate familiarity with the current theories regarding energy use by the first cells.
Duration of Unit: 3 weeks
NJCCCS: 5.1.A1-4, 5.1.B1-2, 5.1.C; 5.2.A.1, 5.2.B1-3; 5.3.A-D; 5.4.A.1; 5.5.B1-2; 5.10.A.1

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What theories for the origins of life on Earth are widely accepted by the scientific community? What evidence supports these theories/hypotheses? What experiences helped Darwin/Wallance develop the theory of Natural Selection? What evidence supports this central theory of biology?	Explain the steps leading to the evolution of the first cells. Understand the ideas of evolution by natural selection as stated by Darwin and Wallace. Identify the main inferences of natural selection. Recognize evolutionary fitness as the contribution of individual to gene pool of next generation. Use Hardy-Weinberg algorithm to analyze variation in populations. Comprehend common misconceptions associated with natural selection and adaptation.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence Lab investigations ▪ Lab interpreting data according to principals of Hardy-Weinberg equilibrium (A.P. or the equivalent)	Written tests and quizzes Critical thinking questions Project assessments Article reviews Lab reports and analyses **including A.P. lab #8: Population**

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
				Genetics and Evolution Responses to discussion questions
How does natural selection occur? What are the main inferences of natural selection? Why did Darwin prefer not to use the term "evolution?" How does natural selection relate to our knowledge of inheritance patterns and molecular genetics? What are some common misconceptions associated with natural selection? How does natural selection account for speciation? What other environmental and abiotic phenomena affect speciation?	Discuss environment's role in evolution. Differentiate between gradualism and punctuated equilibrium stated by Gould. Explore examples of how genetic variation occurs within and between species. Role of mutation and sexual recombination in genetic variation. Explain modes of speciation and selection. Analyze evidence that support natural selection. Interpret the phrase "imperfection of natural selection." Explain how the theory of natural selection accounts for extinction as well as an increase in the proportion of individuals with advantageous characteristics within a species. Analyze how humans act as primary selective forces in the biosphere including their role in extinction.		Cooperative Learning/Experimentation and Analysis ▪ Role of natural selection in science classroom student-led discussion Graphic Organizers: ▪ Concept map/collage demonstrating relationship between terminology associated with evolution by natural selection	

<u>Suggestions on how to differentiate in this unit</u>:
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Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #6: Ecology

Enduring Understandings: Living organisms are interdependent and rarely exist alone in nature.
Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
The environment as a system of interdependent components affected by human activity and natural phenomena.
Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.
Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.

Essential Questions: How can abiotic and biotic dynamics influence population growth?
To what extent to variations in life history strategies affect population growth and interspecific/intrascpefic competition?
How is energy flow through ecosystems related to trophic structures?
How do elements (C,H,O,N,P,S) cycle through ecosystems?
How do organisms affect the cycling of elements and water through biosphere?
How do biotic and abiotic factors affect competition, community structure, and ecosystem functions?
How are humans affecting biogeochemical cycles?

Unit Goal: Students will define ecology and appreciate its importance as a major area of biological science.
Duration of Unit: 4 weeks
NJCCCS: 5.1.B1-2, 5.1.C; 5.2.A.1, 5.3.A-D; 5.4.A.1, 5.4.B.1; 5.10.A.1, 5.10.B1-2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Why is ecology a unifying area in biological and physical sciences? What factors can influence population growth? How does inter-/intraspecies competition shape populations, communities, and ecosystems?	Demonstrate as understanding of the properties of populations and factors that influence their growth. Explain how current human population growth is unique when compared with other mammals. Demonstrate knowledge of and apply examples of Gause's principle of competitive exclusion. Understand symbiosis: predation, parasitism, mutualism, and commensalism. Describe the flow of energy through various ecosystems. Evaluate the role of producers, consumers and detrivores (decomposers).	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence Lab investigations ▪ Dissolved oxygen in eutrophic system (or equivalent for A.P. exam prep) ▪ Animal behavior - kinesis/taxis and competition (or equivalent for A.P. exam prep) ▪ Field trip study of local waterway and surrounding area using standard	Written tests and quizzes Critical thinking questions Project assessments Article reviews Lab reports and analyses including **A.P. lab #11: Animal Behavior; A.P. lab #12: Dissolved Oxygen**

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do symbiotic relationships shape populations, communities, and ecosystems? Explain the role abiotic disturbances play in ecological interactions and succession. How might these disturbances relate to natural selection? What role do humans play in shaping ecological communities and regulation of populations? How have we positively/negatively impacted our environment? What alternatives exist for addressing the environmental and ecological issues currently facing our planet? What are the pro's/con's of each – how can a global society create an enforce an action plan?	Apply the concept of ecological succession in evaluating various types of ecosystems. Understand the characteristics of the following types of environments and the life forms they support: rivers & streams, lakes and ponds, oceans and seashores. Evaluate the importance of human responsibility to protect important biomes such as the tropical rain forest to prevent mass extinctions and control the ever increasing greenhouse effect. Explore and weight the impacts of introducing a new technology in terms of alternative solutions, costs, tradeoffs, risks, benefits and environmental impact.		ecological mapping, sampling, and quantification techniques; macroinvertebrate sampling and calculation of Index of Biological Integrity (IBI) Cooperative Learning/Experimentation and Analysis ▪ Simulation of succession paper lab or active learning activity ▪ Trophic level interaction role play or kinesthetic modeling Graphic Organizers: ▪ Nutrient cycles ▪ Terrestrial and aquatic biomes ▪ Differentiating between models of succession, types of niche, forms of symbiosis, and life history strategies	Responses to discussion questions

<u>Suggestions on how to differentiate in this unit</u>:

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A wide variety of assessments and strategies complement the individual learning experience.

Freehold Regional High School District
Medical Sciences Advanced Placement Biology

Unit #7: Classification and Organismal Biology

Enduring Understandings: Structural levels from molecules to organisms ensure successful functioning in all living organisms and living systems.
Everything from cells to organisms to ecosystems is in a state of dynamic balance that must be controlled by positive or negative feedback mechanisms.
Scientific research often leads to technological advances that can have positive and/or negative impacts on society as a whole.

Essential Questions: How are organisms classified?
How are the representative members of archaebacteria, eubacteria, protista, fungi, plants and animals further classified?
How are patterns of reproduction and development regulated in plants and animals?
How do scientists study evolutionary relationships among organisms?
How is this information used in the classification of organisms?
Why is alternation of generation an adaptive significance in plants?
To what extent do the major body plans of plants and animals exhibit evolutionary patterns?
How does the organization of cells and tissues and organs determine structure and function in plants and animals?
How are structure and function related in the various organ systems?
How do organ systems of animals interact?
To what extent have plants and animals adapted to contribute to their success on land?

Unit Goal: The student will understand principles of taxonomy and systematics of the kingdom and domain systems of classification.
Duration of Unit: 9 weeks
NJCCCS: 5.1.B1-2, 5.1.C; 5.2.A.1, 5.3.A-D; 5.5.A.4; 5.5.B1-2; 5.10.B.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Why is a unified system of classification needed? How has this system changed over time? What factors can influence population growth? How does inter-/intraspecies competition shape populations, communities, and ecosystems?	Discuss the work of Carl Linnaeus and his development of the hierarchical system of classification and binomial nomenclature. List the factors used in modern classification and why. Discuss the six kingdom method of classification including their general characteristics.	Current textbook and resource binders Student workbooks Internet Journal articles Newspapers Videos	Lecture and class discussion Group inquiry activity to allow students to actively construct processes of scientific investigation – including observation, use of technology to collect empirical data, collaboration, as well as evaluation and analysis of data/evidence	Written tests and quizzes Critical thinking questions Project assessments Article reviews Lab reports and analyses **including A.P. lab #9: Transpiration; A.P. lab #10: Circulation**

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do symbiotic relationships shape populations, communities, and ecosystems? Explain the role abiotic disturbances play in ecological interactions and succession. How might these disturbances relate to natural selection? What role do humans play in shaping ecological communities and regulation of populations? How have we positively/negatively impacted our environment? What alternatives exist for addressing the environmental and ecological issues currently facing our planet? What are the pro's/con's of each – how can a global society create an enforce an action plan?	Discuss the significance of biochemical and DNA hybridization techniques in examining evolutionary relationships. Successfully use a classification key to identify various organisms. Discuss the following for each of the 6 kingdoms: ▪ cell structure ▪ nutrition ▪ reproduction strategies ▪ gene regulation and characteristics ▪ role in ecosystem/trophic level ▪ pros/cons to humans. Differentiate between "plant-like," "animal-like," and "fungi-like" protists. Develop appreciation of origin and classification of animals and plants • Demonstrate familiarity with general morphology, physiology., habitats, and reproduction of following animal phyla: porifera, cnidaria, platyhelminthes, rhynchoceola, nematoda, mollusca, annelida, arthropoda, echinodermata, chordate • Compare anatomy and physiology across major plant divisions of systems and tissues responsible for the following: transport/circulation, reproduction, gas exchange, defense, and storage of nutrients. Compare anatomy and physiology across major animal phyla of the following organs/organ systems: circulation, respiration (gas exchange), reproduction, processing of external stimuli (nervous system), digestion, and excretion.		Lab investigations • Lab investigation surveying and highlighting major characteristics of Protista and Fungi • Lab investigation(s) surveying and highlighting major characteristics and systems of Plantae • Lab investigation(s) surveying and highlighting major characteristics and systems of Animalia • Dissection of mammalian heart, brain, eye, and kidney Cooperative Learning/Experimentation and Analysis • Poster symposium: student groups create a poster describing a "new" organism (plant or animal) indicative of the phylum or division they have been assigned. Their new organism must demonstrate typical characteristics and unique adaptations for maximum fitness Graphic Organizers: ▪ Comparison table of the six kingdoms ▪ Comparisons of organ systems between various animal phyla ▪ Comparison of plant specialized, cells, tissues, organs Comparison of plant divisions	Responses to discussion questions

<u>Suggestions on how to differentiate in this unit</u>:

Students with individual learning styles can be assisted through adjustments in assessment standards, one-to-one teacher support, additional testing time, and use of visual and auditory teaching methods.

A wide variety of assessments and strategies complement the individual learning experience.