BEXLEY CITY SCHOOLS

AP BIOLOGY | Curriculum Map and Pacing Guide

COURSE DESCRIPTION: This provides intensive study of topics for students interested in biologically-related fields of study in college. Units of study include ecology, biochemistry, cells, enzymes and metabolism, molecular genetics, heredity, evolution, and plant and animal structure and function. The first three days of each week students meet for extended time (72 minutes) with the remaining days meeting for the regular class period (52 minutes). Students will keep a laboratory notebook and are required to write a scientific paper each quarter and present using Excel® spreadsheets and Lab Quest® with probes.	**Course SCI370** **1 year, 1.25 credit** **Grades 10-12** **Prerequisite:** Physical Science, Honors or regular Biology, teacher recommendation based on grade B or better in Chemistry

QUARTER 1

Topic: Behavioral Ecology

Key Terms: proximate questions, ultimate questions, ethology, fixed-action pattern, imprinting, innate behavior, kinesis, taxis, pheromones, spatial learning, optimal foraging theory, agnostic behavior

Measurable Skills: Design, interpreting and recording data, justify, investigating, making and checking predictions, concluding and presenting data in a Lab report

AP College Board Essential Knowledge	Student Learning Targets (AP Learning Objectives and Science Practices)	Learning Activities/Investigations
2.A.1	L.O. 2.2: Justify a scientific claim that free energy is required for living systems to maintain organization, to grow or to reproduce, but that multiple strategies exist in different living systems. Science Practice (SP) 2, 3, 4, 5	
2.A.1	L.O. 2.3: Predict how changes in free energy availability affect organisms, populations and ecosystems.	
2.E.2	L.O. 2.37: Connect concepts that describe mechanisms that regulate the time and coordination of physiological events.	
2.E.3	L.O. 2.38: Analyze data to support the claim that responses to information and communication to information affect natural selection.	Design Behavior Lab
2.E.3	L.O. 2.40: Connect concepts in and across domains to predict how environmental factors affect responses to information and change behavior.	
2.C.2	L.O. 2.42: Pose a scientific question concerning the behavioral or physiological response of an organism to a change in its environment.	

QUARTER 1		
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Measurable Skills: Design, interpreting and recording data, justify, investigating, making and checking predictions, concluding and presenting data in a Lab report		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.E.1	L.O. 3.40: Analyze data that indicate how organisms exchange information in response to internal changes and external cues, and which can result in changes in behavior.	
3.E.1	L.O. 3.41: Create a representation that describes how organisms exchange information in response to internal changes and external cues, and which can result in changes in behavior.	
3.E.1	L.O. 3.42: Describe how organisms exchange information in response to internal changes or environmental cues.	
1.A.1	L.O. 1.3: Apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future. Science Practice (SP) 1, 2, 4, 5	Obituary Lab
2.D.1	L.O. 2.23: Design a plan for collecting data to show that all biological systems (cells, organisms, populations, communities and ecosystems) are affected by complex biotic and abiotic interactions.	
4.A.5	L.O. 4.11: Justify the selection of the kind of data needed to answer scientific questions about the interaction of populations within communities.	
4.A.5	L.O. 4.12: Apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways.	
4.A.5	L.O. 4.13: Predict the effects of a change in the community's populations on the community.	

QUARTER 1		
Topic: Ecology: Community Ecology		
Key Terms: predation, herbivory, commensalism, mutualism, biogeography, primary succession, secondary succession		
Measurable Skills: Analyzing data, compare and contrast, differentiate, justify		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.E.3	L.O 2.39: Justify scientific claims, using evidence, to describe how timing and coordination of information of behavioral events in organisms are regulated by several mechanisms. Science Practice (SP) 1, 5, 7	Interpreting a Scientific Paper, Inquiry: What Caused the Drastic Decline of the Illinois Greater Prairie Chicken Population? Article 7
4.A.5	L.O. 4.11: Justify the selection of the kind of data needed to answer scientific questions about the interaction of populations within communities.	
2.D.1	L.O. 2.22: Refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems from cells and organisms to populations, communities and ecosystems	Ecology FRQ
4.C.4	L.O. 4.27: Make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability.	
2.D.1	L.O. 2.24: Analyze data to identify possible patterns and relationships between a biotic or abiotic factor and a biological system (cells, organisms, populations, communities or ecosystems).	

QUARTER 1		
Topic: Ecosystems and Restoration Ecology		
Key Terms: Gross primary productivity, Net primary productivity, Eutrophication, Biological magnification, Evapotranspiration, Ecosystem, Trophic levels		
Measurable Skills: Model, collecting, recording, predict, interpreting, communicating, investigate, concluding and presenting data in a lab report and argumentative presentation		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.D.3	L.O. 2.28: Use representations or models to analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems.	Fertilizer Design Lab

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Measurable Skills: Model, collecting, recording, predict, interpreting, communicating, investigate, concluding and presenting data in a lab report and argumentative presentation		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
4.A.4	L.O. 4.9: Predict the effects of a change in a component(s) of a biological system on the functionality of an organism(s).	Prelab Dissolved Oxygen
4.A.4	L.O. 4.10: Refine representations and models to illustrate biocomplexity due to interactions of the constituent parts.	
4.A.5	L.O. 4.12 Apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways.	Eutrophication POGIL Dead Zones: Gulf of Mexico
4.A.6	L.O. 4.14: Apply mathematical routines to quantities that describe interactions among living systems and their environment, which result in the movement of matter and energy.	
4.A.6	L.O. 4.15: Use visual representations to analyze situations or solve problems qualitatively to illustrate how interactions among living systems and with their environment result in the movement of matter and energy.	Dissolved Oxygen Lab Presentation.
4.A.6	L.O. 4.16: Predict the effects of a change of matter or energy availability on communities. Science Practice (SP) 1, 2, 3, 4, 5, 7	Dissolved Oxygen Lab.
4.B.3	L.O. 4.21: Predict consequences of human actions on both local and global ecosystems.	

QUARTER 1		
Topic: Chemistry of Life: Water and Life and Carbon and the Molecular Diversity of Life		
Key Terms: Polar molecule, adhesion, surface tension, cohesion, kinetic energy, specific heat, buffers, hydrocarbons, structural isomers, geometric isomers, enantiomers.		
Measurable Skills: Interpreting, recording, comparing, investigating, reporting.		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.A.3	L.O. 2.8: Justify the selection of data regarding types of molecules that an animal, plant or bacterium will take up as necessary building blocks and excrete as waste products.	Transpiration Lab.
2.A.3	L.O. 2.9: Represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth and reproduction. Science Practice (SP) 1, 2, 3,4, 5, 6, 7	Transpiration pre-lab
1.D.1	L.O. 1.27: Describe a scientific hypothesis about the origin of life on Earth.	Water FRQ Water Demonstration

QUARTER 1		
Topic: Chemistry of Life: Structure and Function of Large Biological Molecules		
Key Terms: Dehydration and hydrolysis reactions, carbohydrates, fats, proteins, nucleic acids, saturated and unsaturated fats, phospholipid, enzymes, amino acids, protein conformation, denaturation, pyrimidine, purine		
Measurable Skills: Compare contrast, collecting and recording data, problem solving the unknowns, distinguishing		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
4.A.1	L.O. 4.1: Explain the connection between the sequence and the subcomponents of a biological polymer and its properties. Science Practice (SP) 3,4,5	Carbohydrate Lab
4.A.1	L.O. 4.2: Refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.	
4.A.1	L.O. 4.3 Use models to predict and justify that changes in the subcomponents of a biological affect the functionality of the	

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Measurable Skills: Compare contrast, collecting and recording data, problem solving the unknowns, distinguishing		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	molecule.	
4.B.1	L.O. 4.17: Analyze data to identify how molecular interactions affect structure and function.	
4.C.1	L.O. 4.22: Construct explanations based on evidence of how variation in molecular units provides cells with a wider range of functions.	

QUARTER 1		
Topic: Tour of the Cell		
Key Terms: Electron microscope, prokaryotic and eukaryotic cell, plasma membrane, (all plant and animal organelles), plasmodesmata, tight junctions, desmosomes, gap junctions		
Measurable Skills: Compare contrast, investigate, predict		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.B.3	L.O. 2.13: Explain how internal membranes and organelles contribute to cell functions. Science Practice (SP) 1,6,7	Root Leaf and Stem Lab
2.B.3	L.O. 2.14: Use representations and models to describe differences in prokaryotic and eukaryotic cells.	
4.A.2	L.O. 4.4: Make predictions about the interactions of subcellular organelles.	
4.A.2	L.O. 4.5: Construct explanations based on scientific evidence as to how interactions of subcellular structures provide essentials functions.	
4.A.2	L.O. 4.6: Use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures which possess specialized functions, provide essential functions.	

QUARTER 1		
Topic: Tour of the Cell		
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Measurable Skills: Compare contrast, investigate, predict		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
4.B.2	L.O. 4.18: Use representations and models to analyze how cooperative interactions within organisms promote efficiency in the use of energy and matter.	

QUARTER 1		
Topic: Membrane Structure and Function of the Cell		
Key Terms: : Selective permeability, amphipathic, fluid mosaic model, integral proteins, peripheral proteins, glycolipids, glycoproteins, concentration gradient, passive and active transport. Isotonic, hypertonic, hypotonic, turgid, plasmolysis, sodium potassium pump, cotransport, exocytosis, endocytosis, proton pump		
Measurable Skills: Design. Investigate, problem solving, compare contrast, construct, critique		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.A.3	L.O. 2.6: Use calculated surface area-to-volume ratios to predict which cells might eliminate wastes or procure nutrients faster by diffusion. Science Practice (SP) 1, 2, 3, 4, 5	Surface Area to Volume Lab
2.A.3	L.O. 2.7: Explain how cell size and shape affect the overall rate of nutrient intake and rate of waste elimination.	"Off to the Races" Lab
2.B.1	L.O. 2.10: Use representations and models to pose scientific questions about the properties of cell membranes and selective permeability based on molecular structure.	Osmosis Pre-Lab
2.B.1	L.O. 2.11: Construct models that connect the movement of molecules across membranes with membrane structure and function.	Diffusion Osmosis Lab
2.B.2	L.O 2.12: Use representations and models to analyze situations or solve problems qualitatively and quantitatively to investigate whether dynamic homeostasis is maintained by the active movement of molecules across membranes.	Diffusion Challenge Lab Water Potential FRQ

QUARTER 2		
Topic: Cell Communication		
Key Terms: Signal transduction pathway, hormones, ligands		
Measurable Skills: Describe, compare contrast, interpret		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.D.1	L.O. 3.31: Describe basic chemical processes for cell communication shared across evolutionary lines of decent. Science Practice (SP) 1,7	Hedgehog Signal Transduction Pathway.
3.D.1	L.O. 3.32: Generate scientific questions involving cell communication as it relates to the process of evolution.	POGIL Signal Transduction Pathway.
3.D.1	L.O. 3.33: Use representations and appropriate models to describe features of a cell signaling pathway.	
3.D.2	L.O. 3.34: Construct explanations of cell communication through cell-to-cell direct contact or though chemical signaling.	
3.D.2	L.O. 3.35 Create representations that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling.	
3.D.3	L.O. 3.36: Describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response.	
3.D.4	L.O. 3.37: Justify claims based on scientific evidence that changes in signal transduction pathways can alter cellular response.	
3.D.4	L.O. 3.38: Describe a model that expresses a key elements to show how change in signal transduction can alter cellular response.	
3.D.4	L.O. 3.39: Construct an explanation of how certain drugs affect signal reception and consequently, signal transduction pathways.	

QUARTER 2		
Topic: Cell Cycle		
Key Terms: Cell cycle, chromosome, genome, somatic cells, chromatin, gametes, cytokinesis, meiosis, mitosis, (all phases of cell cycle), cytokinesis, binary fission, density-dependent inhibition		
Measurable Skills: Record, analyze, conclude, calculate, investigate, compare		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.A.2	L.O. 3.7: Make predictions of natural phenomena occurring during the cell cycle.	Mitosis Pre-Lab
3.A.2	L.O. 3.8: Describe the events that occur in the cell cycle.	Mitosis Lab Microscope
3.A.2	L.O. 3.9: Construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.	Mitosis Lab Standard Deviation Mitosis Lab Chi-Square
3.A.2	L.O. 3.11: Evaluate evidence provided by data sets to support the claim that heritable information is passed from one generation to another generation through mitosis, or meiosis followed by fertilization.	Cancer Activity
2.E.2	L.O.2.35: Design a plan for collecting data to support the scientific claim that the timing and coordination of physiological events involve regulation.	
2.E.2	L.O. 2.36: Justify scientific claims with evidence to show how timing and coordination of physiological events involve regulation.	

QUARTER 2		
Topic: Genetics and Evolutionary History of Biological Diversity: Viruses and Bacteria and Archaea		
Key Terms: Bacteriophage, lytic and lysogenic cycle, prophage, vaccines, viroids, prions, transformation, transduction, conjugation, plasmid, operons, gram positive and negative, photoautotrophs, chemoautotrophs, photoheterotrophs, chemoheterotrophs, nitrogen fixation, obligate aerobes, facultative anaerobes, anaerobic respiration, extremophiles, thermophiles, halophiles, methanogens, symbiosis		
Measurable Skills: Investigate, compare contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.C.3	L.O. 3.29: Construct an explanation of how viruses introduce genetic variation in host organisms. Science Practice (SP): 1, 3, 6, 7	Bacteria Microscope Lab

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Measurable Skills: Investigate, compare contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.C.3	L.O. 3.30: Use representations and appropriate models to describe how viral replication introduces genetic variation in the viral population.	
3.D.1	L.O. 3.31: Describe basic chemical processes for cell communication shared across evolutionary lines of decent.	

QUARTER 2		
Topic: Introduction to Metabolism		
Key Terms: Catabolic and anabolic pathways, kinetic and potential energy, thermodynamics, free energy, endergonic and exergonic reactions, ATP, activation energy, enzymes, substrate, cofactors, coenzyme, allosteric site, feedback inhibition		
Measurable Skills: Design, investigate, present, analyze and collect data, interpret and record		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.A.1	L.O. 2.1: Explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization to grow and reproduce. Science Practice (SP): 1, 3, 4, 5, 6, 7	Enzyme Pre-lab
2.A.1	L.O. 2.2: Justify a scientific claim that free energy is required for living systems to maintain organization, to grow or to reproduce, but that multiple strategies exist in different living systems.	Enzyme Lab
2.A.1	L.O. 2.3: Predict how changes in free energy availability affect organism, populations and ecosystems.	Enzyme Design Lab Lab Presentation
4.B.1	L.O. 4.17: Analyze data to identify how molecular interactions affect structure and function.	Enzyme FRQ

QUARTER 2

Topic: Cellular Respiration and Fermentation

Key Terms: Fermentation, cell respiration, NAD+, FADH2, electron transport chain, glycolysis, citric acid cycle, substrate level phosphorylation, chemiosmosis, proton motive force, anaerobic, facultative anaerobes

Measurable Skills: Modeling, investigation, design, collection, recording, analyzing, and concluding, presentation

AP College Board Essential Knowledge	Student Learning Targets (AP Learning Objectives and Science Practices)	Learning Activities/Investigations
2.A.1	L.O. 2.2: Justify a scientific claim that free energy is required for living systems to maintain organization, grow or to reproduce, but that multiple strategies exist in different living systems. Science Practices (SP) 1, 2, 3, 4, 5, 6, 7	Cell Respiration Pre-lab Cell Respiration FRQ
2.A.2	L.O. 2.4: Pose scientific questions about what mechanisms and structural features allow organisms to capture, store and use free energy.	Cell Respiration Lab with sensors Cell Respiration FRQ
2.A.2	L.O. 2.5: Construct explanations of the mechanisms and structural features of cells that allow organisms to capture store or use free energy.	Cell Respiration Design Lab with sensors
2.A.2	L.O. 2.41: Evaluate data to show the relationship between photosynthesis and respiration in the flow of free energy through a system.	Modeling Cell Respiration Fermentation “In a Bag” Design challenge

QUARTER 3

Topic: Photosynthesis

Key Terms: Chlorophyll, mesophyll, stroma, stomata, thylakoids, light reactions, Calvin cycle, photophosphorylation, photon, action spectrum, photosystems, cyclic/noncylic electron flow, chemiosmosis, photorespiration, CAM

Measurable Skills: Design, investigate, record, analyze, calculate, concluding and presenting data

AP College Board Essential Knowledge	Student Learning Targets (AP Learning Objectives and Science Practices)	Learning Activities/Investigations
2.A.1	L.O. 2.1: Explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow and to reproduce. Science Practices: (SP) 1,2,3,4,5,6,7	Modeling Photosynthesis

QUARTER 3		
Topic: Photosynthesis		
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Measurable Skills: Design, investigate, record, analyze, calculate, concluding and presenting data		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.A.1	L.O. 2.2: Justify a scientific claim that free energy is required for living systems to maintain organization, to grow or to reproduce, but that multiple strategies exist in different living systems.	Photosynthesis Pre-Lab Cell Respiration and Photosynthesis FRQ
2.A.1	L.O. 2.3: Predict how changes in free energy availability affect organisms, populations and ecosystems.	Design Photosynthesis Lab Absorbance Lab Chromatography Lab
2.A.2	L.O.2.4, L.O. 2.5: Use representations to pose scientific questions and construct explanations about what mechanics and structural features allow organisms to capture, store and use free energy.	Florescence Demonstration

QUARTER 3		
Topic: Genetics: Meiosis and Sexual Life Cycles		
Key Terms: Asexual reproduction, gametes, sexual reproduction, autosomes, homologous chromosomes, haploid and diploid cells, zygote, alternation of generations, meiosis (all the phases), crossing over, random fertilization, tetrads, independent assortment		
Measurable Skills: Investigate, collecting and concluding on data, calculating, describing		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.A.2	L.O.3.7: Make predictions about natural phenomena occurring during the cell cycle. **Science Practices (SP) 2,4,5,6,7**	*Sordaria* Lab *Sordaria* Pre-lab
3.A.2	L.O. 3.8: Describe the events that happen in the cell cycle.	
3.A.2	L.O. 3.9: Construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.	
3.A.2	L.O. 3.10: Represent the connection between meiosis and increased genetic diversity necessary for evolution.	
3.A.2	L.O. 3.11: Evaluate evidence provided by data sets to support the	

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Measurable Skills: Investigate, collecting and concluding on data, calculating, describing		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	claim that heritable information is passed from one generation to another generation through mitosis, or meiosis followed by fertilization.	
3.A.3	L.O. 3.12: Construct a representation that connects the process of meiosis to the passage of traits from parent to offspring.	
3.A.3	L.O. 3.13: Pose questions about ethical, social, or medical issues surrounding human genetic disorders.	
3.C.2	L.O. 3.27: Compare and contrast processes by which genetic variation is produced and maintained in organisms from multiple domains.	
3.C.2	L.O. 3.28: Construct an explanation of the multiple processes that increase variation within a population.	

QUARTER 3		
Topic: Genetics: Molecular Basis of Inheritance and Gene to Protein		
Key Terms: Transformation, semiconservative model, DNA polymerase, leading strand, lagging strand, (all replication enzymes) telomeres and transcription, translation, RNA processing, codons, RNA polymerase, introns, exons, spliceosome, anticodon, rRNA, tRNA, mRNA, missense and nonsense mutations, insertions, deletions, translocations, frameshift mutations		
Measurable Skills: Modeling, compare contrast, demonstrate, differentiate, construct.		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.A.1	L.O. 3.1: Construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, that RNA are the primary sources of heritable information.	
3.A.1	L.O. 3.2: Justify the selection of data from historical investigations	

QUARTER 3		
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Measurable Skills: Modeling, compare contrast, demonstrate, differentiate, construct.		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	that support the claim that DNA is the source of heritable information.	
3.A.1	L.O. 3.3: Describe representations and models that illustrate how genetic information is copied for transmission between generations.	
2.E.1	L.O. 2.33: Justify scientific claims with scientific evidence to show that timing and coordination of several events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms. Science Practices (SP) 1,3,6,7	DNA Modeling
3.A.1	L.O. 3.4: Describe representations and models illustrating how genetic information is translated into polypeptides. Science Practice (SP) 1,3,6,7	Transcription Modeling Translation Modeling
3.A.1	L.O. 3.6: Predict how a change in a specific DNA or RNA sequence can result in changes in gene expression.	DNA Synthesis FRQ
3.B.2	L.O. 3.22 Explain how signal pathways mediate gene expression, including how this process can affect protein production	
3.B.2	L.O. 3.23: Use representations to describe mechanisms of the regulation of gene expression.	
3.C.1	L.O. 3.25: Create a visual representation to illustrate how changes in a DNA nucleotide sequence can result in a change in the polypeptide produced.	

QUARTER 3		
Topic: Genetics: DNA Technology and Genomics and Genomes and Their Evolution and Regulation of Gene Expression		
Key Terms: : Biotechnology, restriction enzymes, sticky ends, polymerase chain reaction, gel electrophoresis, RFLPs, human genome project, gene therapy, DNA fingerprint and differential gene expression, nucleosomes proteasomes, Histone Code Hypothesis, differentiation, morphogenesis, cytoplasmic determinants, egg-polarity genes, bicoid, Morphogen Gradient Hypothesis, bioinformatics, proteomics		
Measurable Skills: Investigate, collect, analyze, record, conclude, model, describe		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.A.1	L.O. 3.5: Explain the claim that humans can manipulate heritable information by identifying at least two commonly used technologies. Science Practice (SP) 1, 2, 5, 7	DNA Pre-Lab DNA Forensics Lab
3.C.1	L.O. 3.26: Explain the connection between genetic variations in organisms and phenotypic variations in populations.	Modeling Plasmids Transformation Pre-Lab
4.C.1	L.O. 4.22: Construct explanations based on evidence of how variation in molecular units provides cells with a wider range of functions.	Transformation Lab Firefly POGIL Lac Operon
2.E.1	L.O. 2.31: Connect concepts in and across domains to show that timing and coordination of specific events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms.	Biotechnology FRQ
2.E.1	L.O. 2.32: Use a graph or diagram to analyze situations or solve problems (quantitatively or qualitatively) that involve timing and coordination of events necessary for normal development in an organism.	
2.E.1	L.O.2.34: Describe the role of programmed cell death in development and differentiation, the reuse of molecules, and the maintenance of dynamic homeostasis.	
3.B.1	L.O. 3.18: Describe the connection between the regulation of gene expression and observed differences between different kinds of organisms.	
3.B.1	L.O. 3.19: Describe the connection between the regulation of gene expression and observed differences between individuals in a population.	
3.B.1	L.O. 3.20: Explain how the regulation of gene expression is	

QUARTER 3		
Topic: Genetics: DNA Technology and Genomics and Genomes and Their Evolution and Regulation of Gene Expression		
Key Terms: : Biotechnology, restriction enzymes, sticky ends, polymerase chain reaction, gel electrophoresis, RFLPs, human genome project, gene therapy, DNA fingerprint and differential gene expression, nucleosomes proteasomes, Histone Code Hypothesis, differentiation, morphogenesis, cytoplasmic determinants, egg-polarity genes, bicoid, Morphogen Gradient Hypothesis, bioinformatics, proteomics		
Measurable Skills: Investigate, collect, analyze, record, conclude, model, describe		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	essential for the processes and structures that support efficient cell function.	
3.B.1	L.O. 3.21: Use representations to describe how gene regulation influences cell products and function.	
3.B.2	L.O. 3.22: Explain how signal transduction pathways mediate gene expression, including how this process can affect protein production.	
3.B.2	L.O. 3.23: Use representations to describe mechanisms of the regulation of gene expression.	
4.A.3	L.O. 4.7: Refine representations to illustrate how interactions between external stimuli and gene expression result in specialization of cells tissues and organs.	

QUARTER 4		
Topic: Genetics: Mendel and the Gene Idea and Chromosomal Basis of Inheritance		
Key Terms: Punnett square, phenotype, genotype, complete dominance, incomplete dominance, codominance, alleles, pedigree, deletions, duplications, inversions, and translocations, X inactivation		
Measurable Skills: Calculate, investigate, solve, predict, record, analyze, conclude		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
3.A.3	L.O 3.12: Connect the process of meiosis to the passage of traits from parent to offspring. Science Practice: (SP) 1,2,4, 5,6,7	*Drosophila* Lab
3.A.3	L.O 3.13: Pose questions about ethical, social or medical issues surrounding human genetic disorders.	Genetics Problems
3.A.3	L.O 3.14: Apply mathematical routines to determine Mendelian	

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AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	patterns of inheritance provided by data sets.	
3.A.4	L.O. 3.15: Describe the deviations from Mendel's model of the inheritance of traits.	
3.A.4	L.O. 3.16: Explain how the inheritance patterns of many traits cannot be accounted for by Mendelian genetics.	
3.A.4	L.O. 3.17: Describe representations of an appropriate example of inheritance patterns that cannot be explained by Mendel's model of the inheritance of traits.	
3.C.1	L.O. 3.24: Predict how a change in genotype, when expressed as a phenotype, provides a variation that can be subject to natural selection.	
4.C.2	L.O. 4.23: Construct explanations of the influence of environmental factors on the phenotype of an organism.	
4.C.2	L.O. 4. 24 Predict the effects of a change in an environmental factor on gene expression and the resulting phenotype of an organism.	
4.C.3	L.O. 4.25: Use evidence to justify a claim that a variety of phenotypic responses to a single environmental factor can result from different genotypes within the population.	

QUARTER 4		
Topic: Mechanisms of Evolution: Decent with Modification, Evolution of Population, Origin of Species, and History of Life on Earth		
Key Terms: Natural Selection, Evolution, Catastrophism, Uniformitarianism, Gradualism, Artificial Selection, Homologies and Microevolution, Gene Pool, Hardy-Weinberg Theorem, Mutation, Genetic Drift, Bottleneck Effect, Founder Effect, Gene Flow, Fitness and Speciation, Biological Species Concept, Prezygotic and Postzygotic barriers, Allopatric and Sympatric Speciation, Polyploidy, Adaptive Radiation, Punctuated Equilibrium, and Phylogeny, Monophyletic, Cladogram		
Measurable Skills: Calculate, predict, evaluate, justify using evidence, construct, compare, contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
1.A.1	L.O. 1.1: Convert a data set from a table of numbers that reflect a change in genetic makeup of a population over time and to apply mathematical methods and conceptual understandings to investigate the cause and effect of this change. Science Practice (SP) 2,5,6.	Hardy-Weinberg Lab
1.A.1	L.O. 1.2: Evaluate evidence provided by data to qualitatively and /or quantitatively investigate the role of natural selection in evolution.	
1.A.4	LO. 1.9: Evaluate evidence provided by data from many scientific disciplines that support biological evolution.	Evolution Story
1.A.4	L.O. 1.10: Refine evidence based on data from scientific disciplines that support biological evolution.	HHMI “Making of the Fittest”
1.A.4	L.O. 1.11: Design a plan to answer scientific questions regarding how organismrs have changed over time using information from morphology, biochemistry and geology.	
1.A.4	L.O. 12: Connect scientific evidence from many scientific disciplines to support the modern concept of evolution.	
1.A.4	L.O. 13: Construct or justify mathematical models, diagrams or simulations that represent processes of biological evolution.	
1.B.1	L.O. 1.4: Evaluate data-based evidence that describes evolutionary changes in the genetic makeup of a population over time.	
1.B.1	L.O. 1.5: Connect evolutionary changes in a population over time to a change in the environment.	
1.B.1	L.O. 1.6: Use data from mathematical models based on the Hardy-	

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Measurable Skills: Calculate, predict, evaluate, justify using evidence, construct, compare, contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	Weinberg equilibrium to analyze genetic drift and effects of selection in the evolution of specific populations.	
1.A.3	L.O. 1.7: Justify data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and the effects of selection in the evolution of specific populations.	
1.A.3	L.O. 1.8: Make predictions about the effects of genetic drift, migration and artificial selection on the genetic makeup of a population.	
1.C.3	L.O. 1.25: Describe a model that represents evolution within a population.	
1.C.3	L.O. 1.26: Evaluate given data sets that illustrate evolution as an ongoing process.	
3.C.1	L.O. 3.26: Explain the connection between genetic variations in organisms and phenotypic variations in populations.	
4.C.3	L.O. 4.26: Use theories and models to make scientific claims and or predictions about the effects of variation within populations on survival and fitness.	
4.C.4	L.O. 4.27: Make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability.	HHMI “The Origin of Species: The Beak of the Finch”
1.C.1	L.O. 1.20: Analyze data related to questions of speciation and extinction throughout the Earth’s history. Science Practice (SP) 3, 6, 7	
1.C.1	L.O. 1.21: Design a plan for collecting data to investigate the	

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Measurable Skills: Calculate, predict, evaluate, justify using evidence, construct, compare, contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	scientific claim that speciation and extinction have occurred throughout the Earth's history.	
1.C.2	L.O. 1.22: Use data from real or simulated populations , based on graphs or models of types of selection, to predict what will happen to the population in the future.	
1.C.2	L.O. 1.23: Justify the selection of data that addresses questions related to reproductive isolation and speciation.	
1.C.2	L.O. 1.24: Describe speciation in an isolated population and connect it to change in gene frequency, change in environment, natural selection and/or genetic drift.	
1.B.1	L.O. 1.14: Pose scientific questions that correctly identify essential properties of shared, core life processes that provide insights in to the history of life on Earth.	
1.B.1	L.O. 1.15: Describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms.	
1.B.1	L.O. 1.16: Justify the scientific claim that organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.	HHMI " Great Transitions"
1.D.1	L.O. 1.27: Describe a scientific hypothesis about the origin of life on Earth.	
1.D.1	L.O. 1.28: Evaluate scientific questions based on hypotheses about the origin of life on Earth.	

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Measurable Skills: Calculate, predict, evaluate, justify using evidence, construct, compare, contrast		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
1.D.1	L.O. 1.29: Describe the reasons for revisions of scientific hypotheses of he origin of life on Earth.	
1.D.1	L.O. 1.30: Evaluate scientific hypotheses about the origin of life on Earth.	
1.D.1	L.O. 1.31: Evaluate the accuracy and legitimacy of data to answer scientific questions about the origin of life on Earth.	
1.D.2	L.O. 1.32: Justify the selection of geological, physical, and chemical data that reveal early Earth conditions.	
4.B.3	L.O. 4.19: Use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and abundance.	
4.B.3	L.O. 4.20: Explain how the distribution of ecosystems changes over time by identifying large-scale events that have resulted in these changes in the past.	

QUARTER 4		
Topic: Evolutionary History of Biological Diversity: Phylogeny and the Tree of Life		
Key Terms: Phylogeny, Taxonomy, Phylogenetic Tree, Cladistics		
Measurable Skills: Create, Justify, Model, Evaluate		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
1.B.2	L.O. 1.17: Pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to identify shared characteristics, make	POGIL Phylogenetic Tree

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AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
	inferences about the evolutionary history of the group and identify character data that could extend or improve the phylogenetic tree**.** Science Practices (SP) 1, 3, 5, 6	
1.B.2	L.O. 1.18: Evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history and speciation.	Phylogenetic Trees FRQ
1.B.2	L.O. 1.19: Create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set.	
1.D.2	L.O. 1.32: Justify the selection of geological, physical, and chemical data that reveal early Earth conditions.	
2.D.2	L.O. 2.25: Construct explanations based on scientific evidence that homeostatic mechanisms reflect continuity due to common ancestry and/or divergence due to adaptation in different environments.	
2.D.2	L.O. 2.26: Analyze data to identify phylogenetic patterns or relationships, showing that homeostatic mechanisms reflect both continuity due to common ancestry and change due to evolution in different environments.	

QUARTER 4		
Topic: Plant Form and Function: Plant Responses; Animal Form and Function, Immune System, Hormones and Endocrine System, Neurons Synapses Signaling, and Nervous System		
Key Terms: Etiolation, signal transduction, phototrophism, circadian rhythms, photoperiodism, systemic acquired resistance and innate immunity, adaptive immunity, phagocytes, t-cells, b-cells, inflammatory response, antibodies, humoral and cell-mediated immune response and endocrine, paracrine, autocrine, hormone, signal transduction, names of glands /hormones and functions, negative and positive feedback and neurons, central and peripheral nervous system, cell body, dendrite, axon, membrane potential, action potential, synapsis and motor and autonomic nervous system, regions of brain and functions		
Measurable Skills: Analyze, justify, compare, differentiate		
AP College Board Essential Knowledge	**Student Learning Targets (AP Learning Objectives and Science Practices)**	**Learning Activities/Investigations**
2.E.2	L.O. 2.37: Connect concepts that describe mechanisms that regulate the timing and coordination of physiological events.	Plant Hormone Lab
2.E.3	L.O. 2.38: Analyze data to support the claim that responses to information and communication of information affect natural selection.	Brain Lab
2.D.4	L.O. 2.29: Create representations and models to describe immune responses.	
2.D.4	L.O. 2.30: Create representations or models to describe nonspecific immune defenses in plants and animals.	
2.C.2	L.O. 2.21: Justify the selection of the kind of data needed to answer scientific questions about the relevant mechanism that organisms use to respond to changes in their external environment.	
2.C.1	L.O. 2.15: Justify a claim made about the effects on a biological system at the molecular, physiological or organismal level when given a scenario in which one or more components within a negative regulatory system is altered.	
2.C.1	L.O. 2.16: Connect how organisms use negative feedback to maintain their internal environments.	
2.C.1	L.O. 2.17: Evaluate data that show the effects of changes in concentrations of key molecules on negative feedback mechanisms.	

QUARTER 4		
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Measurable Skills: Analyze, justify, compare, differentiate		
2.C.1	LO. 2.18: Make predictions about how organisms use negative feedback mechanisms to maintain their internal environments.	
2.C.1	L.O. 2.19: Make predictions about how positive feedback mechanisms amplify activities and processes in organisms based on scientific theories and models.	
2.C.1	L.O. 2.20: Justify that positive feedback mechanisms amplify responses in organisms.	
2.D.2	L.O. 2.27: Connect differences in the environment with the evolution of homeostatic mechanisms.	
2.D.4	L.O. 2.43: Connect the concept of cell communication to the functioning of the immune system.	
3.D.1	L.O. 3.31: Describe basic chemical processes for cell communication shared across evolutionary lines of decent.	
3.D.1	L.O. 3.33: Use representations and appropriate models to describe features of a cell signaling pathway.	
3.D.2	L.O. 3.34: Construct explanations of cell communication through cell-to-cell direct contact or from a distance through chemical signaling.	
3.E.2	L.O. 3.43: Construct an explanation, based on scientific theories and models, about how nervous systems detect external and internal signals, transmit and integrate information and produce responses.	
3.E.2	L.O. 3.44: Describe how nervous systems detect external and internal signals.	

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Measurable Skills: Analyze, justify, compare, differentiate		
3.E.2	L.O. 3.45: Describe how nervous systems transmit information.	
3.E.2	L.O. 3.46: Describe how the vertebrate brain integrates information to produce a response.	
3.E.2	L.O. 3.47: Create visual representations of complex nervous systems to describe/explain how these systems detect external and internal signals, transmit and integrate information, and produce responses.	
3.E.2	L.O. 3.48: Create a visual representation to describe how nervous systems detect external and internal signals.	
3.E.2	L.O. 3.49: Create a visual representation to describe how nervous systems transmit information.	
3.E.2	L.O. 3.50: Create a visual representation to describe how the vertebrate brain integrates information to produce a response.	
4.A.4	L.O. 4.8: Evaluate scientific questions concerning organisms that exhibit properties due to the interaction of their constituent parts.	Pig Dissection

District Instructional Resource:

Principles of Life for AP (2014) / Bedford Freeman & Worth (6-year online subscription: 2019-2020 to 2024-2025)

Standards Alignment:

AP Biology Course and Exam Description (2015) – retrieved Jan. 2, 2019 https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap-biology-course-and-exam-description.pdf