Title	**Roxbury High School Biology A**
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Curriculum Writing History	
Notes	
Attachments	

Title : Roxbury High School Biology A
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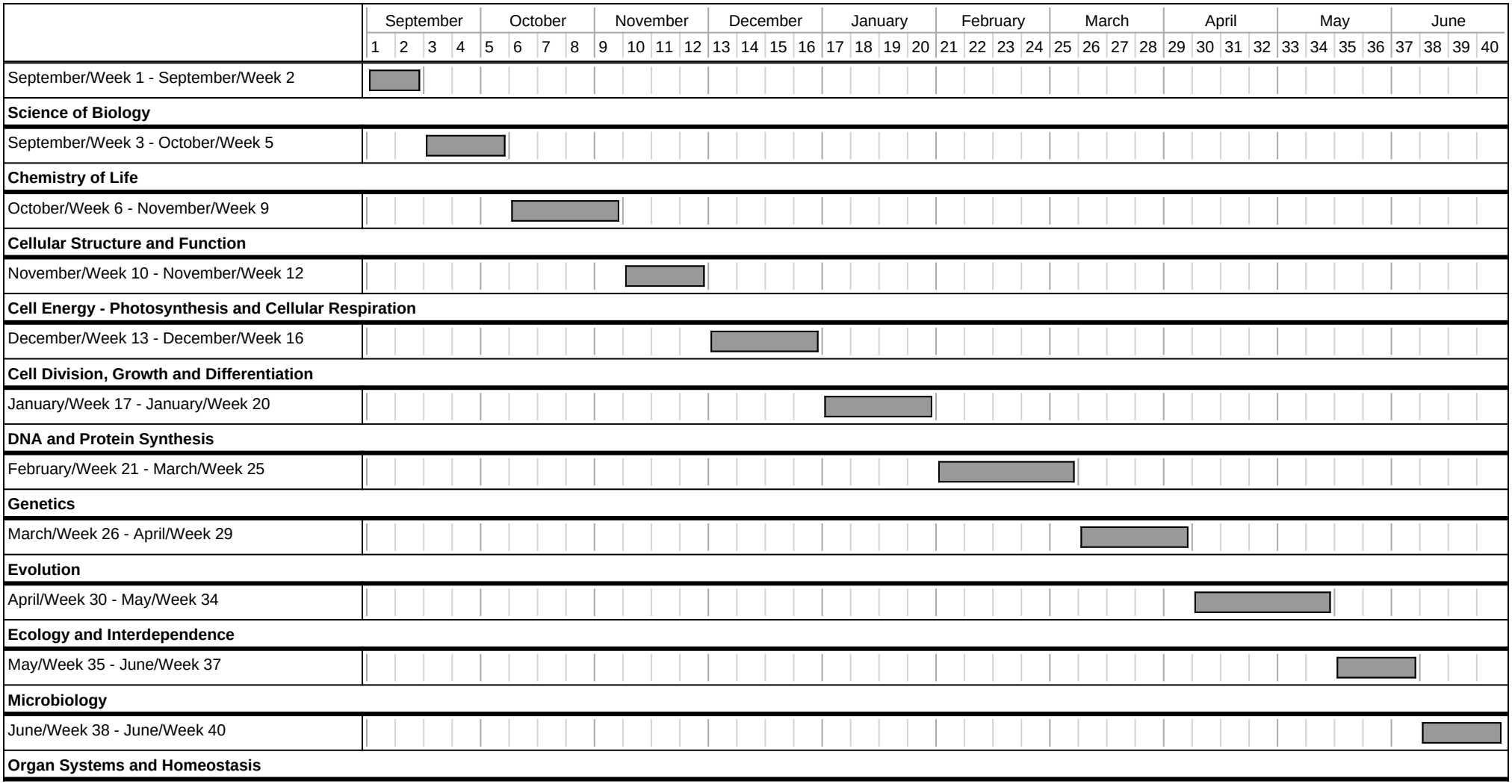

Title : Roxbury High School Biology A
Type : Consensus

Duration: September/Week 1 - September/Week 2					
UNIT NAME: Science of Biology					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Measurement and observation tools are used to categorize, represent and interpret the natural world. • Evidence is used for building, refining, and or critiquing scientific explanations. • Scientific knowledge builds itself over time. • The growth of scientific knowledge involves critique and communication - social practices that are governed by a core set of values and norms. • All living things, from simple to complex, share certain characteristics. • All levels of life have systems of related parts.	• What is a controlled experiment? • How do we build and refine models that describe and explain the natural and designed world? • What constitutes useful scientific evidence? • How is scientific knowledge constructed? • How does scientific knowledge benefit from scientists sharing and debating ideas and information with peers? • How does technology affect our world - past, present, and future? • What are the characteristics of living things? • How can life be studied at different levels? **Suggested Time Frame** • Nature of Biology: 1-2 blocks • Controlled Experimental Design: 2 blocks • Graphing: 1 blocks	• Biology is a process of inquiry where scientific methods are used to answer questions and learn about the natural world. • Controlled experiments isolate one variable and test a hypothesis. • Data collected from an experiment can be displayed using graphs and analyzed to form conclusions. • A theory explains a wide range of observations.	• Apply the use of scientific tools effectively through the completion of laboratory exercises • Form a valid hypothesis and design an experiment to test the effects of one variable • Collect and represent data using tables and graphs • Analyze data and form conclusions. • Differentiate between the following: ◦ independent and independent variables; ◦ control group and experimental group(s) ◦ hypothesis, theory, and law • Recognize terminology, specific facts, and general concepts related to the nature of biological science, designing experiments, and major themes of biology. **Suggested Activities** • Nature of Science Checks Lab • Scientific Method Case Studies		HS.LS1.3.CNS.1-Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity , skepticism, replicability of results, and honest and ethical reporting of findings. (HS -LS1-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.CNS.1-A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new ev idence is discov ered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-LS4-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.SEP.1-Plan and conduct an investigation individually and

			• Design A Controlled Experiment Written Report • Graphing and Analyzing Data		collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.SEP-Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS - LS1-6),(HSLS2-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.3.CNS.1-Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing

					evidence. (HS-LS2-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.6.CNS.1-Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HSLS2-6), (HS-LS2-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.1-Technological advances have influenced the progress of science and science has influenced advances in technology . (HSLS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.2-Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.CNS.2-Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-LS4-1),

					(HSLS4-4) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: September/Week 3 - October/Week 5					
UNIT NAME: Chemistry of Life					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• All living organisms are based on atoms and their interactions. • Carbon based molecules are the foundation of life. • Large biomolecules are often composed of long chains (polymers) of simple repeating building blocks (monomers). • Metabolism is all of the chemical reactions within an organism where compounds are formed and broken down. • Enzymes are catalysts for chemical reactions in living things.	• What elements make up living things? • How are the elements in our bodies used to make the larger molecules that make up our structure? • What functions do carbohydrates, proteins, lipids and nucleic acids have in all living organisms? • How do enzymes carry out an organism's metabolism? **Suggested Time Frame** • Basic Chemistry: 1 block • Organic Compounds: 3 blocks • Enzymes: 1-2 blocks	• Living things consists of atoms of different elements. • Carbon forms the basis of organic compounds which are the building blocks of cells. • The four major types of biomolecules are carbohydrates, lipids, proteins, and nucleic acids. • Large biomolecules (macromolecules) are often composed of long chains (polymers) of simple repeating building blocks (monomers). • Each class of organic compound has unique properties, structures, and functions in living things. • Bonds break and form during chemical reactions. • Chemical reactions release or absorb energy. • Enzymes carry out metabolic processes such as aiding in digestion (ie. lactase)	• Interpret and compare nutritional labels and assess the nutritional value of foods with respect carbohydrates, fats, and proteins and the needs of our cells • Form hypotheses about the organic composition in food samples • Test and assess the presence of organic compounds in food samples • Test, assess, and form conclusions regarding enzymatic action • Recognize terminology, specific facts, and general concepts related to basic and organic chemistry related to the biology of living things. **Suggested Activities** • Nutritional Label Analysis Assignment • Testing for Organic Compounds (sugars, starches, proteins, lipids) • Liver Catalase Enzyme Activity		HS.LS1.6-Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.5.CCC.1-Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.DCI.LS1.C.2-As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different way s to form different products. (HS-LS1-6),(HS-LS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.5.SEP.1-Use a

		• Enzymes are catalysts that speed up and lower activation energy needed for chemical reactions. **Not to Include (as per NGSS)** • Atomic structure and bonding • Water Properties • pH (except when related to enzyme activity)			model based on evidence to illustrate the relationships between systems or between components of a system. (HSLS1-5),(HS-LS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.SEP-Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS - LS1-6),(HSLS2-3) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: October/Week 6 - November/Week 9					
UNIT NAME: Cellular Structure and Function					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Structure and function are related in biology. • The cell is the basic unit of structure and function of all living things. • Cells take highly varied forms in different plants, animals and microorganisms. Structural variations among cells determine the function each cell performs. • Cells have distinct and separate structures, which perform an monitor processes essential for the survival of the cell. The highly specific function of each organelle is directly related to its function. • Homeostatic balance is maintained at every level of organization from the individual cell to the whole organism. • Cell membranes allow cells to maintain homeostasis.	• How are cells structured? • What are the characteristics of prokaryotes and eukaryotes? • How does structure relate to function in living systems from the cellular level to the level of the organism? • How do diffusion and osmosis allow a cell to obtain materials it needs for its metabolism? • What role does the membrane play in the cell's ability to maintain homeostasis? **Suggested Time Frame** • Microscopes and Cell Structure: 3-4 blocks • Cell Membrane and Transport: 4-5 blocks	• There are many levels of organization within an organism including biochemicals, organelles, cells, tissues, organs, and organ systems. • Cells are the basic unit of life. • Early studies and the development and refinement of the microscope led to the development of the cell theory. • Prokaryotic cells lack a nucleus and most internal structures of eukaryotic cells. • Eukaryotic cells share many similarities. • Cells have internal structures and organization. • Several organelles are involved in making and processing proteins. • Plant cells have cell walls and chloroplasts. • The cell membrane is a barrier that separates a cell from the external environment.	• Effectively operate a microscope and located objects under a various magnifications • Compare various eukaryotic cells under compound light microscope and identify basic cell features: cytoplasm, cell membrane, cell wall, nucleus • Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. • Predict a cell's response in a given set of environmental conditions. • Analyze and interpret data to determine the energy requirements and/or rates of substance transport across cell membranes.		LS1.A-Structure and Function (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.1.DCI.LS1.A.1-Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.2-Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multi-cellular organisms. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.DCI.LS1.A.1-Multicellular organisms have a hierarchical

• Microscopes have been designed and refined over the centuries, resulting in the modern compound light microscope as the primary tool for viewing cells.		• A cell obtains the materials needed for metabolism as well as gets rid of metabolic wastes via transport through the membrane. • Cellular membranes are composed of phospholipids, proteins, and cholesterol. • Chemical signals are transmitted across the membrane. • The cell membrane is responsible for the maintenance of homeostatic balance. • Materials move across membranes because of concentration differences. • Diffusion and osmosis are forms of passive transport. • Some molecules diffuse through transport proteins. • Cells use energy to transport materials that cannot diffuse across a membrane. • Proteins can transport materials against a concentration gradient. • Endocytosis and exocytosis transport materials across the membrane in vesicles.	• Compare organisms that live in freshwater and marine environments, and identify the challenges of osmotic regulation for these organisms. • Describe the effect of temperature change on the rates of diffusion and osmosis. • Analyze case studies of disorders and discuss which cell structures are most likely affected or involved in producing the symptoms associated with the disease • Describe how a disease is the result of a malfunctioning system, organ, and cell, and relate this to possible treatment interventions (e.g., diabetes, cystic fibrosis, lactose intolerance). • Use tools to gather, view, analyze and interpret data produced during scientific investigations that involve passive and active transport. • Use computer simulations and models to analyze cell transport mechanisms.		structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.3-Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.DCI.LS1.A.1-Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.CCC.1-Feedback (negative or positive) can stabilize or destabilize a system. (HS-

			• Differentiate between: ◦ prokaryotic and eukaryotic cells ◦ cell membrane and cell wall ◦ passive and active transport ◦ animal and plant cells ◦ positive and negative feedback loops • Recognize terminology, specific facts, and general concepts related to cellular structures and organization, organic compounds of the cell membrane, and cellular maintenance of homeostasis via the processes of cellular transport. **Suggested Activities** • How to Operate a Microscope • Comparing Cells (cheek vs. onion vs. elodea) • Red Onion Osmosis Lab		LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.1.SEP.1-Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS - LS1-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce

					reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.1-Technological advances have influenced the progress of science and science has influenced advances in technology . (HSLS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.2-Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: November/Week 10 - November/Week 12					
UNIT NAME: Cell Energy - Photosynthesis and Cellular Respiration					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structure within the organism. • Photosynthesis is the process that captures energy from the environment and converts it into sugar, a form of stored energy useful to living things. • Energy captured by the process of photosynthesis is used to support life on Earth. • Cellular respiration is a process that releases stored energy in nutrients. • The energy released by cellular respiration fuels an organism's metabolism. • Photosynthesis and cellular respiration cycle materials on Earth including oxygen, carbon dioxide, and sugar.	• How are matter and energy transferred/ transformed in living systems? • How is stored chemical energy accessed and released via cellular respiration? • How do the processes of photosynthesis and cellular respiration cycle materials on Earth? **Suggested Time Frame** • Photosynthesis: 2 blocks • Respiration: 2 blocks • Comparison/Cycles: 2-3 blocks	• All cells need chemical energy. • The chemical energy used for most cell processes is carried by ATP. • Organisms break down carbon-based molecules to produce ATP. • A few types of organisms do not need sunlight and photosynthesis as a source of energy. • The overall process of photosynthesis produces sugars that store chemical energy. • Photosynthetic organisms are producers. • Photosynthesis in plants occurs in chloroplasts. • The overall process of cellular respiration converts sugars into ATP using oxygen. • Cellular respiration makes ATP by breaking down sugars. • Cellular respiration is the mirror image of photosynthesis. • Cellular respiration is an aerobic process.	• Explain how energy is stored and released from sugar and ATP. • Compare and contrast the processes of photosynthesis and respiration. • Explain the role that photosynthesis and cellular respiration play in the carbon cycle and water cycle. • Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. • Trace the energy transferring path from the sun into sugar molecules through the process of photosynthesis. • Design a controlled experiment that would test the effect of limiting factors on the rate of photosynthesis. • Trace the path of energy being released from sugar to make ATP through the process of cellular respiration.		HS.LS1.5-Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.5.SEP.1-Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HSLS1-5),(HS-LS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.5.DCI.LS1.C.1-The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.5.CCC.1-Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-

		• Fermentation allows the production of a small amount of ATP without oxygen. • Fermentation and its products are important in several ways. • Photosynthesis and cellular respiration cycle materials in the environment. **Not to Include (as per NGSS)** • Electromagnetic Spectrum • Specific chemical reactions of photosynthesis or respiration stages • Pigments and Chromatography Lab	• Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. • Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. • Recognize terminology, specific facts, and general concepts related to basic and organic chemistry, metabolism, cellular energy, and cycling of materials related to the processes of photosynthesis and respiration. **Suggested Activities** • Design a Controlled Experiment Written Report • Anaerobic Respiration Lab (yeast or exercise)		LS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6-Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. (09-12) [Regional:Next Generation Science Standards (NGSS)] LS1.C-Organization for Matter and Energy Flow in Organisms (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.DCI.LS1.C.1-The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS -LS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.DCI.LS1.C.2-As matter and energy flow

					through different organizational levels of living systems, chemical elements are recombined in different way s to form different products. (HS-LS1-6),(HS-LS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.6.CCC.1-Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.7-Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.7.SEP.1-Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HSLS1-5),(HS-LS1-7) (09-12)[Regional:Next

					Generation Science Standards (NGSS)] HS.LS1.7.DCI.LS1.C.1-As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different way s to form different products. (HS-LS1-6),(HS-LS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.7.DCI.LS1.C.2-As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another and release energy to the surrounding environment and to maintain body temperature. Cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. (HS-LS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.7.CCC.1-Energy cannot be created or destroy ed—it only moves between one place and another place, between objects and/or fields, or between systems.(HS-

					LS1-7),(HS-LS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.3-Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. (09-12)[Regional:Next Generation Science Standards (NGSS)] LS2.B-Cycles of Matter and Energy Transfer in Ecosystems (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.3.DCI.LS2.B.1-Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HSLS2-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.3.CCC.1-Energy drives the cycling of matter within and between systems. (HS-LS2-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.5.DCI.LS2.B.1-Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged

					among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.5.DCI.PS3.D.2- The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to HS-LS2-5) (09-12)[Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: December/Week 13 - December/Week 16					
UNIT NAME: Cell Division, Growth and Differentiation					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• In multicellular organisms, mitosis is a process for growth, repair, and maintenance. • Multicellular organisms begin as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material to both daughter cells. • In sexual reproduction, chromosomes can exchange sections during meiosis, thereby creating new genetic combinations and thus more genetic variation. • Cancer occurs when cells inappropriately reenter the cell cycle and begin to make additional cells that lead to the formation of tumors and metastases.	• How do organisms grow? • How did all of the cells in our bodies come from just one cell? • How do cells know when to divide? • What is cancer and what does it have to do with normal cell division? • What are stem cells and how can/should they be used to treat disease? • If all cells come from only one cell, how can they all look so different and do many different jobs? • How is genetic material passed from one generation to the next at the cellular level from parent cell to daughter cells? • How is genetic material passed from one generation to the next at the organismal level from parents to offspring? **Suggested Time Frame**	• Cells have distinct phases of growth, reproduction, and normal functions. • The cell cycle has four main stages. • Cells divide at different rates. • Cell size is limited. • Cells divide during mitosis and cytokinesis. • Chromosomes condense at the start of mitosis. • Mitosis and cytokinesis produce two genetically identical daughter cells. • Cell cycle regulation is necessary for healthy growth. • The cell cycle is highly regulated and controlled by a variety of internal and external signals. • Cancer is caused by uncontrolled cell growth due to failure of cell cycle regulation. • Many organisms reproduce by cell division.	• Properly prepare wet mount of onion root tips • Use a microscope to locate and identify cells that are in various stages of the cell cycle, primarily those in the process of division • Observe sample of cells in field of view and calculate the percent of time spent during each notable stage - interphase, prophase, metaphase, anaphase, and telophase • Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.		HS.LS1.4-Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.4.DCI.LS1.B.1-In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that div ides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.2.DCI.LS3.B.1-In

• Stem cells are cells that can continuously generate daughter cells of certain types might be useful in repairing lost or damaged tissues. • During early stages of development, cells differentiate and specialize.	• Cell Cycle and Mitosis: 3 blocks • Cancer: 1-2 blocks • Meiosis: 2-3 blocks • Karyotypes: 1 block • Stem Cells / Differentiation: 1-2 blocks	• Binary fission is similar in function to mitosis. • Some eukaryotes reproduce through mitosis. • Cells work together to carry out complex functions. • Multicellular organisms depend on the interactions among different cell types. • Specialized cells perform specific functions. • Stem cells can develop into different cell types. • Gametes have half the number of chromosomes that body cells have. • You have body cells and gametes. • Your cells have autosomes and sex chromosomes. • Body cells are diploid; gametes are haploid. • During meiosis, diploid cells undergo two cell divisions that result in haploid cells. • Haploid cells develop into mature gametes for sexual reproduction.	• Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations. • Develop, communicate, and justify an evidence‐based scientific explanation for how a whole organism can be cloned from a differentiated ‐ or adult – cell. • Analyze karyotypes to identify the presence of certain genetic disorders caused by errors in meiosis. • Describe modern applications of the regulation of cell differentiation and analyze the benefits and risks (e.g., stem cells, sex determination). • Recognize terminology, specific facts, and general concepts related to cell division, sexual reproduction, organismal growth, differentiation during development.		sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.SEP.1-Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.SEP.1-Plan and

		• Independent assortment and crossing over during meiosis result in genetic diversity. • Sexual reproduction creates unique gene combinations. • Several methods help map human chromosomes such as gene maps and karyotypes. **Not to Include (as per NGSS)** • Specific events at meiosis stages (simply meiosis I and meiosis II) • Different types of stem stem cells and specific locations in embryo regarding differentiation	• Differentiate between: ◦ mitosis and meiosis ◦ haploid and diploid ◦ parent and daughter cells ◦ autosomes and sex chromosomes ◦ growth and development of a multicellular organism ◦ sexual and asexual reproduction **Suggested Activities** • Onion Root Tip Mitosis Lab • The Faces of Cancer Activity • Mitosis / Meiosis Comparison Poster • Online Mitosis / Meiosis Comparison Webquest • Karyotype Analysis Web Assignment • Stem Cell Web Assignment / Debate		conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.SEP.1-Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS - LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.4.SEP.1-Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.SEP.1-Design,

					evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.8.SEP.1-Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.SEP.1-Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually, and mathematically). (HS-LS4-1) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: January/Week 17 - January/Week 20					
UNIT NAME: DNA and Protein Synthesis					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• All cells contain genetic information in the form of DNA molecules. • Heritable information provides for the continuity of life. • Genes are regions in the DNA that contain the instructions that code for the formation of proteins. • All cells in an organism have the same DNA but the genes used (expressed) by the cell may be regulated in different ways. • Not all DNA segments code for proteins, but may instead be involved in regulatory or structural functions. • Mutations are changes in the DNA sequence and are a source of genetic variation.	• What is the structure of a DNA molecule and how do its properties allow it to function and replicate? • How does the structure of DNA encode for information about making proteins? • How is genetic information transferred through generations? • What are genes? • What are mutations? • How does a cell carry out the information stored in DNA? • Is all of DNA used for making proteins? **Suggested Time Frame** • DNA Structure and Replication: 2-3 blocks • RNA Structure and Transcription: 2 blocks • Translation / Protein Synthesis: 2-3 blocks • Mutations: 1-2 blocks	• DNA structure is the same in all organisms. • DNA is composed of four types of nucleotides. • Watson and Crick developed an accurate model of DNA's three-dimensional structure. • Nucleotides always pair up in the same way. • DNA replication copies the genetic information of a cell. • Proteins carry out the process of replication. • Transcription converts a gene into a single-stranded RNA molecule. • RNA carries DNA's instructions. • Transcription makes three types of RNA. • Translation converts an mRNA message into a polypeptide, or protein. • Amino acids are coded by mRNA base sequences. • Amino acids are linked to become a protein.	• Construct a model that represents the structure of DNA • Distinguish between structure and function of DNA and RNA. • Decipher the genetic code. • Analyze gene mutations and their effect on protein production. • Recognize terminology, specific facts, and general concepts related to basic and organic chemistry, storing genetic information, transmitting genetic information for protein production, as well as mutations that may occur throughout the process. **Suggested Activities** • DNA Structure Puzzle Activity • DNA Extraction Lab • Protein Synthesis Activity (Pokemon or CHNOPS)		HS.LS1.1-Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.1.SEP.1-Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS - LS1-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.1.DCI.LS1.A.2-All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the

• DNA molecules from individuals can be isolated and examined for a variety of purposes including paternity testing, identity verification, crime scene analysis, disease ‑ risk analysis, gene therapy, and genetic engineering.		• The structure of DNA molecules leads to their ability to make copies of themselves (replication), act as a template for RNA construction (transcription), and for those RNA molecules to drive protein synthesis (translation). • Mutations are changes in DNA that may or may not affect phenotype. • Some mutations affect a single gene, while others affect an entire chromosome. • Mutations can be caused by several factors. • Mutations in DNA can lead to changes in amino acid sequences which can potentially affect the ability of a protein to function properly. **Not to Include (per NGSS)** • Specific steps / factors involved in Replication, Transcription, Translation such as Initiation, Elongation, and Termination			instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary C ore Idea is also addressed by HS-LS3-1.) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.1.CCC.1-Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.1-Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed

					from parents to offspring. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.DCI.LS1.A.1-All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS -LS1-1.) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.DCI.LS3.A.2-Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-y t known function. (HS-

					LS3-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.2-Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.2.DCI.LS3.B.1-In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)]

Title : Roxbury High School Biology A
Type : Consensus

Plans:

Title : Roxbury High School Biology A
Type : Consensus

Duration: February/Week 21 - March/Week 25					
UNIT NAME: Genetics					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Offspring are not clones of their parents, but a unique combination of genes. • In sexual reproduction, offspring receive half of their chromosomes from the father and half from the mother. • Physical (phenotype) and chemical (genotype) characteristics in an organism pass from parents through known patterns of inheritance and can be used to calculate the probability of certain traits occurring in the offspring. • Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. • Mutations can alter inheritance patterns which may lead to diversity of species or disease.	• Can we predict what future offspring will be like based on the traits that the parents have? • How is genetic information and characteristics of one generation passed to the next? • How can individuals of the same species and even siblings have different characteristics? • What factors affect the expression of traits? • How do genetic mutations affect an organism? A species? **Suggested Time Frame** • Gregor Mendel: 1 block • Mono and dihybrids: 2 blocks • Co- and Incomplete Dominance: 1-2 blocks • Multiple Alleles: 1-2 blocks • Sex-linked Traits: 1-2 blocks • Pedigrees: 2 blocks	• Gregor Mendel's research showed that traits are inherited as distinct units. • Mendel's data revealed patterns of inheritance. • Through sexual reproduction, offspring inherit half of their genetic information from each parent. • Genes encode proteins that produce a diverse range of traits. • The same gene can have many versions (alleles). • Genes influence the development of traits. • The inheritance of traits follows the rules of probability. • Punnett squares illustrate genetic crosses. • A monohybrid cross involves one trait; a dihybrid cross involves two traits. • Heredity patterns can be calculated with probability.	• Identify phenotypes and genotypes of certain individuals and determine the probable outcome in a variety of genetic crosses. • Describe how genetics and the environment contribute to an organism's physical traits. • Simulate gamete production, fertilization, and recombination of genes to determine the phenotype of offspring through a lab exercise • Analyze a variety of autosomal inheritance patterns including complete dominance, codominance, incomplete dominance, and multiple alleles traits as well as the inheritance patterns of sex-linked traits such as hemophilia, colorblindness and muscular dystrophy.		HS.LS1.4-Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.4.SEP.1-Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS -LS1-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.4.DCI.LS1.B.1-In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that div ides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a

		• The chromosomes on which genes are located can affect the expression of traits. • Two copies of each autosomal gene affect phenotype. • Males and females can differ in sex-linked traits. • Phenotype is affected by many different factors. • Phenotype can depend on the interactions of alleles. • Many genes may interact to produce one trait. • The evironment interacts with genotype. • A combination of methods is used to student human genetics. • Human genetics follows the patterns seen in other organisms. • Females can carry sex-linked genetic disorders. • A pedigree is a chart for tracing genes in a family. • Several method help map human chromosomes such as gene maps and karyotypes.	• Determine probable outcome of a genetic cross outcomes; report outcomes in percentages, fractions, as well as ratios • Analyze pedigrees to determine the inheritance pattern of a particular trait • Analyze karyotypes to identify the presence of certain genetic disorders caused by errors in meiosis. • Differentiate between the following: ◦ gene and allele ◦ genotype and phenotype ◦ homozygous and heterozygous ◦ homologous and nonhomologous chromosomes ◦ autosome and sex chromosome ◦ haploid and diploid • Recognize terminology, specific facts, and general concepts related to gamete production, DNA organization, fertilization, inheritance of gene combinations, and analysis of patterns of inheritance of certain traits and disorders.		complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.4.CCC.1-Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions including energy , matter, and information flows—within and between systems at different scales. (HS-LS1-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.1-Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.SEP.1-Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.DCI.LS1.A.1-All

		• The source of variations among individuals of the same species lies within natural variations of genes, random mutations in genetic material, crossing over during meiosis, and recombination during fertilization.	• **Suggested Activities** ◦ Make a Baby (simulate gametes, fertilization, formation of genotype, and determination of phenotype) ◦ Disorder Project / Brochure ◦ Create Your Family Pedigree of a particular trait of interest		cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS -LS1-1.) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.DCI.LS3.A.2- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA . The instructions for forming species' characteristics are carried in DNA . All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-y t known function. (HS-LS3-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.1.CCC.1-

					Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.2-Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS3.2.DCI.LS3.B.1-In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in

					genes, and viable mutations are inherited. (HS-LS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.2.DCI.LS3.B.2-Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3-Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.2.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.SEP.1-Apply

					concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS - LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.1- Technological advances have influenced the progress of science and science has influenced advances in technology . (HSLS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CNS.2-Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.DCI.LS3.B.1- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental

					factors. (HS-LS3-2),(HS-LS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS3.3.CCC.1-Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth v s. exponential growth). (HSLS3-3) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: March/Week 26 - April/Week 29					
UNIT NAME: Evolution					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• The process of evolution drives the diversity and unity of life. • According to specific evidence, all life on Earth evolved from a common ancestor through evolutionary processes. • Natural selection only occurs if there is variation in the genetic information between organisms in a population and variation in traits that leads to differences in performance among individuals in a given environment. • Traits that positively affect survival are more likely to be reproduced and thus are more common in the population. • Genetic diversity within the population allows for reproductive success in the event of environmental change.	• Why are there so many different kind of organisms on Earth? • What evidence shows that different species are related? • Are all organisms on Earth related to each other? • Why would organisms change over time? • What is natural selection? • How does natural selection encourage inter- and intraspecific diversity over time? • How is speciation linked to environmental change? • How can patterns of characteristics shared among organisms be used to categorize life's diversity according to relatedness? • What are some of the mechanisms for evolution? • How are humans involved in controlling evolution? **Suggested Time Frame** • Charles Darwin: 1 block • Evidence of Evolution: 3 blocks	• Charles Darwin's voyage provided insights into evolution. • Darwin observed differences among island species. • Darwin observed fossil and geologic evidence supporting an ancient Earth. • Darwin proposed natural selection as a mechanism for evolution. • Natural selection acts on existing variations. • Evidence of common ancestry among species comes from many sources. • Structural patterns are clues to the history of a species. • New technology is furthering our understanding of evolution. • Molecular and genetic evidence support fossil and anatomical evidence. • A population shares a common gene pool. • Genetic variation in a population increases the chance that some individuals will survive. • Populations, not individuals, evolve. • Species can become extinct. **Not to Include/Emphasize (as**	• Analyze a variety of biological evidence that supports species relatedness and evolution. • Describe how the environment determines which adaptations are beneficial and passed down to offspring. • Describe several mechanisms by which evolution occurs including mutation, migration, genetic drift, and natural selection. • Recognize terminology, specific facts, and general concepts related to adaptations, natural selection, evidence of evolution, mechanisms of evolution, and biochemistry as it applies to evolution. • Analyze and interpret multiple lines of evidence supporting the idea that all species are related by common ancestry such as molecular studies, comparative anatomy, biogeography, fossil record and embryology.		HS.LS4.1-Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.SEP.1-Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually, and mathematically). (HS-LS4-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.CNS.1-A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If

• Genetic information provides strong evidence of evolution. • Multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. • Human activities can influence evolution of species both through actions upon the environment and directly through the manipulation of an organism's DNA.	• Mechanisms of Evolution / Speciation: 3 blocks	**per NGSS)** • Geological change • Lamarck's Hypothesis • Hardy-Weinberg Principle	• Generate a model - an evolutionary tree - showing how a group of organisms is most likely diverged from common ancestry. • Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • Evaluate the evidence supporting claims that changes in environmental conditions may result in increases in the number of individuals of some species, the emergence of new species over time, and the extinction of other species. **Suggested Activites** • Natural Selection Case Studies (rock pocket mouse, peppered moth, etc) • DNA / Amino Acid Sequence Analysis • Primate Anatomical Comparison Lab or Opposable Thumb (Pendactyl) Lab		new ev idence is discov ered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-LS4-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.CNS.2-Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-LS4-1), (HSLS4-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.1.DCI.LS4.A.1-Genetic information prov ides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1) (09-12) [Regional:Next Generation Science Standards (NGSS)]

					HS.LS4.1.CCC.1-Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HSLS4-1), (HS-LS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.2-Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.2.SEP.1-Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer

					review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS4-2),(HS-LS4-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.2.DCI.LS4.B.1- Natural selection occurs only if there is both (1)variation in the genetic information between organisms in a population and (2)variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.2.DCI.LS4.C.2- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and

					reproduce, and (4) the ensuing proliferation of those organisms that are better able to surviv e and reproduce in that environment. (HS-LS4-2) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.2.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HSLS4-2),(HS-LS4-4), (HS-LS4-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.3-Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.3.SEP.1-Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-

					LS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.3.DCI.LS4.B.2- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.3.DCI.LS4.C.3- dominated by organisms that are anatomically , behaviorally , and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.3.DCI.LS4.C.4- Adaptation also means that the distribution of traits in a population can change when conditions

					change. (HS-LS4-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.3.CCC.1-Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HSLS4-1), (HS-LS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.4-Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.4.SEP.1-Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS4-2),(HS-LS4-4) (09-12) [Regional:Next Generation Science Standards

					(NGSS)] HS.LS4.4.DCI.LS4.C.1- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally , and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.5.DCI.LS4.C.2- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (HS-LS4-5) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Title : Roxbury High School Biology A
Type : Consensus

Duration: April/Week 30 - May/Week 34					
UNIT NAME: Ecology and Interdependence					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Key chemicals for life such as carbon, nitrogen, phosphorus, and water are exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. • Food webs are formed by interdependent organisms in a local community that rely on each other for their basic chemical and energy requirements. • Since energy transfer from organism to organism is inefficient, there are generally fewer organisms at higher levels of a food web. • Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support.	• How do living organisms get the chemicals that they need to build their bodies? • What limits the growth of populations? • How and why do organisms interact with their environment, and what are the effects of these interactions? • What are food webs? • Why are there so few organisms at the top of a food web? • How are matter and energy transferred in an ecosystem? • In what ways are organisms dependent on each other? • What happens when new ecosystems are created or when existing communities undergo massive changes such as in a forest fire? • How have humans adversely impacted biodiversity and how can these effects be remedied? **Suggested Time Frame** • Intro / Levels of Organization: 1 day	• Ecology is the study of the relationships among organisms and their environment. • Ecologists study environments at different levels of organization. • Every ecosystem includes both living (biotic) and nonliving (abiotic) factors. • Changing one factor in an ecosystem can affect many other factors. • Life in an ecosystem requires a source of energy. • Producers provide energy for other organisms in an ecosystem. Almost all producers obtain energy from sunlight. • Food chains and food webs model the flow of energy in an ecosystem. • A food chain is a model that shows a sequence of feeding relationships. • A food web shows a complex network of feeding relationships.	• Define and distinguish between matter and energy, and how they are cycled or lost through life processes. • Analyze food chains and food webs of various communities and identify trophic levels, producers, types of consumers, as well as the impact if one or more of the organisms experienced a population increase or decrease. • Provide examples of the impacts of human activities on the environment and biodiversity. • Analyze and interpret data from experiments on ecosystems where matter has been added or withdrawn such as through application of fertilizer or during drought conditions. • Use computer simulations to analyze how energy flows through trophic levels.		HS.LS2.1-Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.1.SEP.1-Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HSLS2-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.1.DCI.LS2.A.1-Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size

• If new environments open up for organisms to colonize or a pre‑existing community is disrupted, the number and the complexity of species present in each area will increase over time. • Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). • Changes in the environment that are caused by human activity can disrupt an ecosystem and threaten the survival of some species.	• Energy Flow / Trophic Levels: 3 blocks • Pyramids: 1 block • Shaping an Ecosystem: 3 blocks • Population Ecology: 4 blocks • Human Impact: 3 blocks	• Carbon, nitrogen, phosphorus, and water are cycled through an ecosystem through a variety of processes. • Pyramids model the distribution of energy and matter in an ecosystem. • Every organism has a habitat and niche. • Organisms interact as individuals and as populations. • Competition and predation are two important ways in which organisms interact. • Symbiosis is a close relationship between different species. • Changes in population's size are determined by immigration, births, emigration, and deaths. • Population growth is determined by available resources. • Ecological factors limit population growth.	• Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. • Differentiate between: ◦ producers and consumers ◦ autotrophs and heterotrophs ◦ food chains and food webs ◦ primary and secondary succession ◦ types of symbiotic relationships ◦ habitat and niche ◦ exponential and logistic growth ◦ density dependent and independent limiting factors		were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1), (HS-LS2-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.1.CCC.1-The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.2-Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.2.SEP.1-Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) (09-12) [Regional:Next Generation Science Standards

		• Ecological succession is a process of change in the species that make up a community. Succession occurs following a disturbance in an ecosystem. Devastated communities, in terms of primary and secondary succession, progress differently over time at different rates. **Not to Include (as per NGSS)** • Cycles are covered in Cell Energy Unit - Reviewed lightly during Ecology • Role of Climate • Biomes • Aquatic Ecosystems	• Recognize terminology, specific facts, and general concepts related to matter and energy cycles, ecosystem interactions, carrying capacities, ecological succession, and human impact on the environment. **Suggested Activities:** • Effects of Acid Rain on Germinating Seeds • Galapagos Marine Food Web • Symbiosis Activity • Owl Pellet Dissection Lab • Conservation Island		(NGSS)] HS.LS2.2.CNS.1-Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.2.DCI.LS2.A.1-Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1), (HS-LS2-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.2.DCI.LS2.C.2-A complex set of interactions

					within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability . (HS-LS2-2),(HS-LS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.2.CCC.1-Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.6-Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of

					organisms in stable conditions, but changing conditions may result in a new ecosystem. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.6.SEP.1-Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.6.CNS.1-Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HSLS2-6), (HS-LS2-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.6.DCI.LS2.C.1-A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the

					ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability . (HS-LS2-2),(HS-LS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.6.CCC.1-Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),(HSLS2-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.7-Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.SEP.1-Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

					(HS-LS2-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.DCI.LS2.C.1- Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.DCI.LS4.D.2- Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HS-LS2-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.DCI.ETS1.B.3- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability , and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HSLS2-7),(secondary to HS-LS4-6) (09-12)

					[Regional:Next Generation Science Standards (NGSS)] HS.LS2.7.CCC.1-Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),(HSLS2-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.8-Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.8.SEP.1-Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-8) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS2.8.CNS.1-Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships betw een ideas and ev idence that may result in rev ision of an explanation. (HSLS2-6), (HS-LS2-8) (09-12) [Regional:Next Generation Science Standards (NGSS)]

					HS.LS2.8.DCI.LS2.D.1-Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.8.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8),(HS-LS4-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.6-Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.6.SEP.1-Create or revise a simulation of a phenomenon, designed device, process, or system. (HS -LS4-6) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS4.6.DCI.LS4.C.1-Changes in the physical environment, whether naturally occurring or

					human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.6.DCI.LS4.D.2- Humans depend on the living world for the resources and other benefits provided by biodiversity . But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7), (HS-LS4-6) (09-12) [Regional:Next Generation

					Science Standards (NGSS)] HS.LS4.6.DCI.ETS1.B.3- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability , and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HSLS2-7),(secondary to HS-LS4-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.6.DCI.ETS1.B.4- Both physical models and computers can be used in various way s to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary to HS-LS4-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.6.CCC.1- Empirical evidence is required to differentiate between cause and

					correlation and make claims about specific causes and effects. (HS-LS2-8),(HS-LS4-6) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology A
Type : Consensus

Duration: May/Week 35 - June/Week 37					
UNIT NAME: Microbiology					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Single-celled organisms can be prokaryotic or eukaryotic. • Even simpler forms of life such as unicellular organisms demonstrate the complementary nature of structure and function.	• What are some of the simpler forms of life? • In what ways are prokaryotic and eukaryotic cells different? • What important functions do prokaryotes serve? • How do the structures of unicellular organisms complement their functions and allow them to meet their needs for survival? **Suggested Time Frame** • Bacteria: 4 blocks • Protisits: 4 blocks	• Bacteria and single-celled prokaryotes. • Prokaryotes are widespread on Earth. • Bacteria have various strategies for survival (conjugation and endospores). • Prokaryotes perform important functions for organisms and ecosystems. They provide nutrients to humans and other animals as well as assist in bioremediation. • Some bacteria cause disease. Antibiotics are used to fight bacterial infections. Bacteria can and have evolved resistance to antibiotics. • Animal-like protists, such as paramecia and amoebas, move in various ways involving cilia, flagella, and pseudopods. • Plant-like protists, such as algae and euglena, contain chloroplasts.	• Differentiate between several microorganisms including various types of bacteria, euglena, paramecia, amoeba • Identify the features of unicellular organisms including bacteria, euglena, paramecia, amoebas • Properly prepare a wet mount slide • Properly locate and identify a variety of microorganisms under the microscope • Recognize terminology, specific facts, and general concepts related to microscopy, cell structure and function, levels of organization, homeostasis, and biochemistry as it applies to microorganisms. **Suggested Activities** • Build A Bacterium Activity		HS.LS1.3.DCI.LS1.A.1-Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)]

			• Antibiotic Resistant Bacteria Lab (Zone of Inhibition Analysis) • Which Microbe Are You? Online Quiz • Analyze Pond Water Under Microscope (or specific Protist Cultures)		
Plans:					

Duration: June/Week 38 - June/Week 40					
UNIT NAME: Organ Systems and Homeostasis					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Complex organisms are composed of systems of tissues and organs that work together to meet the needs of the whole organism. • Feedback mechanisms maintain a living system's internal conditions within certain limits even as external conditions change.	• How are our bodies organized? • How do organisms stay alive when it gets too hot or cold, or too wet or dry? **Suggested Time Frame** • Organ Systems: 2-3 blocks • Homeostasis: 2-3 blocks	• The human body has five levels of organization. • Specialized cells develop from a single zygote. • Specialized cells function together in tissues, organs, organ systems, and the whole organism. • Homeostasis is the regulation and maintenance of the internal environment. • Conditions within the body must remain within a narrow range. • Negative feedback loops are necessary for homeostasis. • Systems interact to maintain homeostasis. • Each organ system affects other organ systems. • A disruption in homeostasis can be harmful. **Not to Include (as per NGSS)** • In depth organ functions	• Know the levels of organization in an organism and provide examples at each level. • Know the overall structures and functions associated with each organ system. • Differentiate between positive and negative feedback loops with regard to homeostatic balance. • Discuss how two or more body systems interact to promote health for the whole organism. • Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. • Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.		HS.LS1.3-Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.4.DCI.LS1.B.1-In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that div ides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.DCI.LS1.A.1-Feedback mechanisms

			• Recognize terminology, specific facts, and general concepts related to levels of organization, cell structure and function, and biochemistry as it relates to organ systems and homeostasis. **Suggested Activities** • Homeostasis: A Balancing Act • Blood Sugar Relation Activity		maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.3.CCC.1-Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS1.2-Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multi-cellular organisms. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.LS1.2.DCI.LS1.A.1-Multicellular organisms have a hierarchical structural organization, in which any one system is

					made up of numerous parts and is itself a component of the next level. (HS-LS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					