Title	**Roxbury High School Biology Honors**
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Curriculum Writing History	
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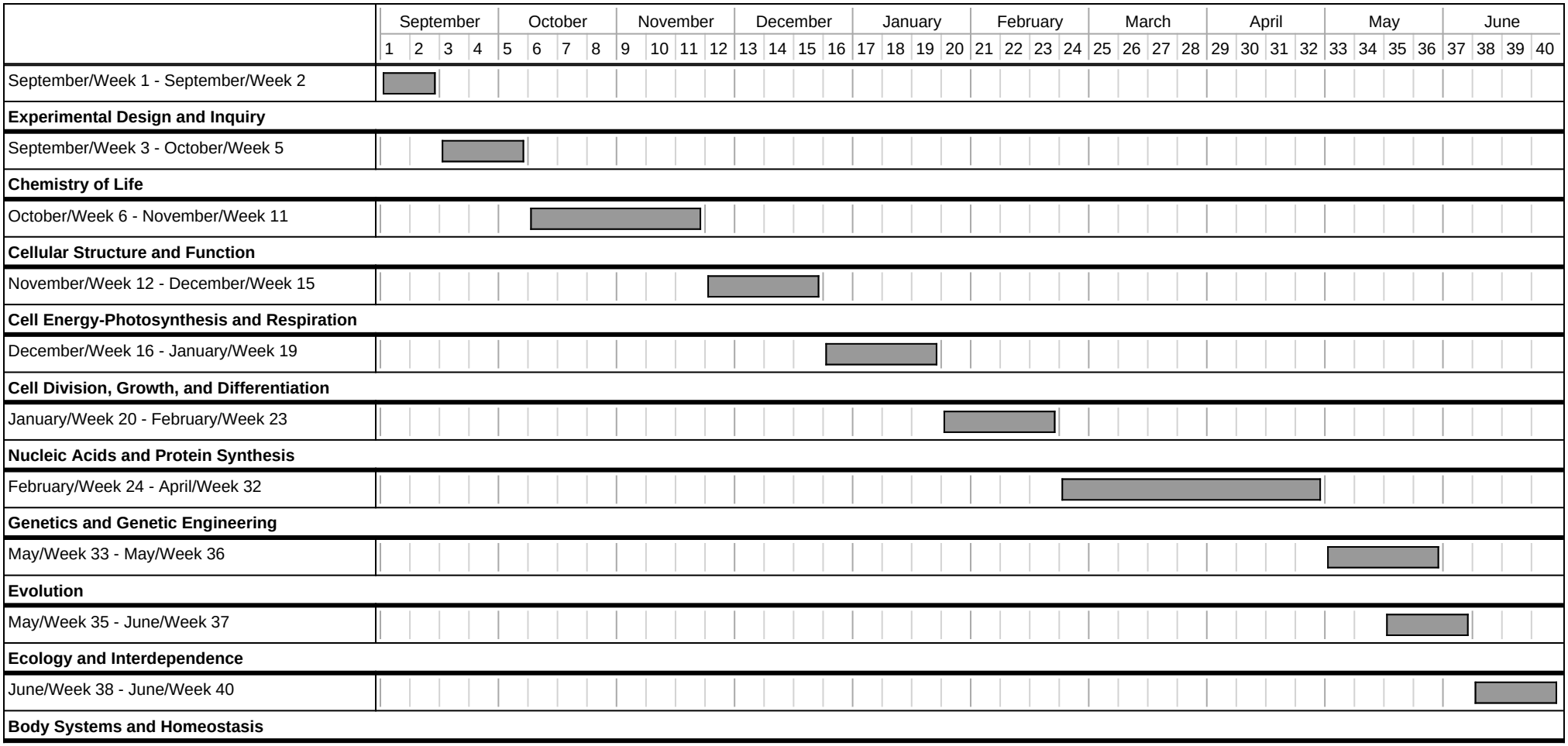
Attachments	

Title : Roxbury High School Biology Honors
Type : Consensus



Title : Roxbury High School Biology Honors
Type : Consensus

Duration: September/Week 1 - September/Week 2					
UNIT NAME: Experimental Design and Inquiry					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Measurement and observation tools are us categorize, represent an interpret the natural wor • Scientific evidence can gained from conducting controlled experiments. • Evidence is used for building, refining, and o critiquing scientific explanations. • Scientific knowledge bu itself over time. • The growth of scientific knowledge involves crit and communication - sc practices that are gover by a core set of values norms. • All living things, from sin to complex, share certa characteristics. • All levels of life have systems of related parts	• What is a controlled experiment? • How can experiments b conducted safely? • How do we build and refin models that describe and explain the natural and designed world? • How can data be represen charts, tables, and graphs • What constitutes useful scientific evidence? • How is scientific knowledg constructed? • How does scientific knowl benefit from scientists sha and debating ideas and information with peers? • How does technology affe world - past, present, and future? • What are the characteri of living things? • How can life be studied different levels?	• Biology is a process of inq where scientific methods a used to answer questions related to living things and about the natural world. • Controlled experiments isc one variable and test a hypothesis. • Safety guidelines must be followed when conducting investigations. • A hypothesis is a possible solution to a scientific prob and can be tested through experimentation. • Data collected from an experiment can be display using graphs and analyze form conclusions. • A theory explains a wide r of observations. • Biological knowledge is a combination of studies fro many scientists and is constantly evolving. • Living things possess 6 ke characteristics.	• Apply the us scientific too effectively a safely throu completion c laboratory exercises • Form a valic hypothesis a design an experiment t the effects c variable • Measure & r data. Communica data using ta and graphs. • Analyze da and form conclusion		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.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

			• Differentiate between the following: ◦ ◦ ◦ • Recognize terminology specific fac and genera concepts related to t nature of biological science, designing experiment and major themes of biology. • Compare / contrast features of living and nonliving things. • Critique laboratory design through various methods of peer review.		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.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.LS1.6.SEP-Construct and revise an explanation based on valid and

			<u>Suggested Activities</u> Ghost Beads Lab - Observation and Experimental Design Graphing Activities		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.LS2.2.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)]
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: September/Week 3 - October/Week 5					
UNIT NAME: Chemistry of Life					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• All livi organi are compo of molec • All life earth depen water surviva • Severa carbon based molec are the founda of life. • Large biomo are oft compo of long chains (polym of sim repeat buildin blocks (mono	• What elements make u living things? • What properties does w have that give it life sustaining qualities? • How are elements in our b combined to make molecu • How are molecules combi broken down to make othe organic compounds that compose our bodies? • What functions do carbohydrates, proteins, li and nucleic acids have in living organisms? • What is the role of enzy in metabolism and homeostasis? • What factors can affect enzyme's function? • How do feedback loops an organism maintain homeostasis? • What role does ATP pla metabolism?	• Living thing consists m of carbon, hydrogen, oxygen, an nitrogen. Water is a molecule th acts as a universal solvent. Water also temperatur stabilizing cohesive properties. • Carbon for the basis o organic compounds which are t building blo of cells. • The four m types of biomolecul are carbohydra lipids, prote and nucleic acids.	• Interpret and compare nutritional labels and asse nutritional value of foods w respect carbohydrates, fat proteins and the needs of cells. • Predict the pH of various substances and compare collected data. • Analze the properties of w • Form hypotheses about organic composition in samples • Test and assess the presence of organic compounds in food sam • Test, assess, and form conclusions regarding enzymatic action • Distinguish between hydol and condensation reactior • Recognize terminology, specific facts, and gene concepts related to bas and organic chemistry related to the biology of living things **<u>Suggested Activities:</u>** Chemical Reaction Lab (Foil) Properties of Water Lab Magic Sand Lab/Demo pH and Buffers Lab Compounds of Living Things Lab Enzyme Lab(s) Organic Compounds		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.LS1.6-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.LS1.6.DCI.LS1.C.1-The sugar molecules thus formed contain carbon,

• Metab is all o chemi reactio within organi where compo are for and br down. • Enzym are catalys for chemi reactio living t • Living require energy do wo and mainta homeo		• Large biomolecul (macromol are often composed long chains (polymers) simple repeating building blo (monomers • Each class organic compound unique properties, structures, functions ir living thing • Bonds brea and form d chemical reactions; hydrolysis condensati reactions. • Chemical reactions c be exother or endothe	Webquest		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-A s 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.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.CCC.1-Energy drives the cycling of matter within and between systems. (HS-LS2-3) (09-12)[Regional:Next

		• Enzymes c out metabo processes which may on feedbac loops to maintain homeostas Temperatu pH, concentrati etc., can al affect enzy function. • Enzymes a catalysts th speed up a lower activ energy nee for chemica reactions.			Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: October/Week 6 - November/Week 11					
UNIT NAME: Cellular Structure and Function					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• The structure and funct cells, cell parts, and of tissues, etc. are related biology. • The cell is the basic uni structure and function o living things. • Cells take highly varied forms in different plants animals and microorgar • Structural variations am cells determine the func each cell performs. • Cells have distinct and separate structures, wh perform an monitor processes essential for survival of the cell. The highly specific function each organelle is direct related to its function. • Homeostatic balance is maintained at every lev organization from the individual cell to the wh organism. • Cell membranes allow to maintain homeostasi controlling movement o molecules in and out of • Microscopes have beer designed and refined ov the centuries, resulting modern compound light microscope as a useful for viewing cells.	• How are cells structured? • What are the characteristi prokaryotes and eukaryote • In what ways are plant an animal cells alike and diffe • How does structure relate function in living systems the cellular level to the lev the organism? • What are the main organe and what are their functior supporting the cell? • How do diffusion and osm allow a cell to obtain mate needs for its metabolism? • What are the various form cell transport, including ac and passive transport? • What role does the memb play in the cell's ability to maintain homeostasis? • How does the structure of plasma membrane affect i permeability? • How is the microscope us properly to observe and measure cells?	• There are r levels of organizatio within an organism including biochemica organelles, cells, tissue organs, an organ syste • Cells are th basic unit o • Early studi and the developme and refiner of the microscope to the developme the cell the • Prokaryotic lack a nucl and most internal structures eukaryotic	• Effectively operate a microscope locate and measure objects und various magnificati • Compare various eukaryotic prokaryotic under compound microscope identify bas cell feature cytoplasm, membrane wall, nucle • Develop ar use a mod illustrate th hierarchica organizatio interacting systems th provide spe functions w multicellula organisms.		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.LS1.1.DCI.LS1.A.2-All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the 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.LS1.3-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

		• Eukaryotic are more complex ar contain a nucleus. • Plant and animal cell both eukar and share common organelles. Plants hav chloroplast cell walls, Animal cell have centri • Each organ and cell pa has a spec function cri to the over productivity health of th • The differe parts of the microscope used to loc observe ar measure specimens	• Predict a ce response in given set of environmen conditions. • Investigate relationship between diffusion ar cell size. • Develop a model of th membrane explain hov component determine function. • Describe the effect of temperature change on t rates of diffu and osmosis • Analyze ca studies of disorders a discuss wh cell structu are most li affected or involved in producing t symptoms associated the disease		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-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.LS1.3.CCC.1-Feedback (negative or positive) can stabilize or destabilize a system. (HS-

		• The cell membrane selectively permeable barrier that separates from the external environme • A cell obtai the materia needed for metabolism as well as rid of meta wastes via transport through the membrane • Cellular membrane composed phospholip proteins, carbohydra and choles • Chemical signals are transmitted across the membrane	• Describe ho disease is th result of a malfunctioni system, orga and cell, and relate this to possible treatment interventions (e.g., diabet cystic fibros lactose intolerance) • Use tools t gather, viev analyze an interpret da produced during scie investigatio that involve passive an active trans • Use compu simulations models to analyze ce transport m		LS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)]

		• The cell membrane responsible the maintenan homeostati balance. • Materials n across membrane because of concentrati differences • Diffusion, a osmosis ar forms of pa transport. • Some molecules diffuse thro transport proteins. • Cells use energy to transport materials th cannot diffu across a membrane • Proteins ca transport materials against a concentrati gradient.	• Differentiat between: ◦ ◦ ◦ ◦ ◦		

		• Endocytosi and exocyt transport materials a the membr in vesicles.	• Recognize terminology specific fac and genera concepts related to cellular structures organizatio organic compounds the cell membrane cellular maintenan homeostas the proces of cellular transport. **Suggested Activities:** Intro to Microscopes Lab Cell Model Project Plant vs Animal Microscope Lab Prokaryote vs Eukaryote Lab Homeostasis Lab Diffusion & Cell Size Lab Red Onion Plasmolysis Lab Egg, Carrot, etc Osmosis Lab Active Transport Webquest		
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: November/Week 12 - December/Week 15					
UNIT NAME: Cell Energy-Photosynthesis and Respiration					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
	• How are matter and energ transferred/ transformed ir living systems? • In what form(s) do cells and transfer energy? • What organelles are responsible for carrying photosynthesis and cell respiration? • How is stored chemical er accessed and released via cellular respiration? • How do the processes of photosynthesis and cellula respiration cycle materials Earth? • What are the reactants an products of the processes photosynthesis and respir • How do different cells o organisms release ener from food?	• All ene • The use pro AT • Org car mo AT • A f org sur pho sou • The pho pro sto • Ph org pro • Ph occ • The of a cor AT	• Explain how energy is sto and release sugar and A • Compare ar contrast the processes o photosynthe and respirat including reactants ar products • Explain the that photosynthe and cellular respiration p the carbon c and water cy • Use a mod illustrate ho photosynth transforms energy into stored che energy.		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-LS1-6) (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

		• Ce ma dov • Org aer res on • Ae pro cor • Fer pro am oxy • Fer pro cor	• Trace the energy transferring from the su into sugar molecules through the process of photosynth • Design a controlled experiment would test effect of lim factors on t rate of photosynth • Trace the p of energy b released fr sugar to m ATP throug process of cellular respiration. • Construct a revise an explanation based on evidence fo cycling of m and flow of energy in aerobic and anaerobic conditions.		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.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

		• The pho as res • Ph cell ma env forr forr pho res the Th forr pro hyc car larg cell	• Investigate effect of va food sourc fermentatic rates. Develop a model to illustrate th role of photosynth and cellula respiration the cycling carbon am the biosphe atmospher hydrosphe and geospl • Recognize terminology specific fac and genera concepts related to b and organi chemistry, metabolism cellular ene and cycling materials related to t processes photosynth and respira **Suggested Activities:** Chloroplyll		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)] 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-Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.5.DCI.LS2.B.1-Photosynthesis and cellular respiration are important components of

			Chromatography Lab Photosynthesis & Leaf Structure Lab Photosynthesis Webquest Carbon Cycle Virtual Lab / Online Tutorial Fermentation in Yeast Lab		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)]

• All organis transfer ma and conve energy fro form to an Both matte energy are necessary build and maintain structure w the organis • Photosynth is the cellu process tha captures e from the environme and conve into sugar, form of sto energy use living thing • Energy captured fr the sun du the proces • photosynth is used to support life Earth. Cells use common molecule t store and transfer en					

• Cellular respiration process tha releases st energy in nutrients. Different organisms in their met of respirati • The energy released by cellular respiration an organis metabolism • Photosynth and cellula respiration materials o Earth inclu water, oxyg carbon diox and larger carbon molecules.					
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: December/Week 16 - January/Week 19					
UNIT NAME: Cell Division, Growth, and Differentiation					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• In multicell organisms, mitosis is a process for growth, rep and maintenan cells and tissues. • Multicellula organisms begin as a single cell (fertilized e that divides successive produce m cells, with parent cell passing identical ge material to daughter c • Sexual reproductio results in increased genetic div Asexual reproductio results in identical daughter c	• How do different organi grow? • How did all of the cells i bodies come from just cell? • How do cells know whe divide? • What are the different phases of a cells life cy and how do these vary cell to cell? • What is cancer and wha does it have to do with normal cell division? • What are stem cells an can/should they be use treat disease? • If all cells come from on one cell, how can they look so different and do many different jobs? • How is genetic material passed from one gener to the next at the cellula level from parent cell to daughter cells? • How is genetic material passed from one gener to the next at the organ level from parents to offspring? • How does meiosis achi increased genetic varia	• Cells have distinct pha of growth, reproductio and norma functions. • The cell cy has four m stages. • Cells divide different ra • Cell size is limited. • Cells divide during mito and cytokin • The proces cytokinesis differs in pl and animal • Mitosis and cytokinesis produce tw genetically identical daughter c	• Use a microscope locate and identify cel that are in various sta of the cell c primarily th in the proc of division • Observe sa of cells in f of view and calculate th percent of spent durin each notab stage - interphase, prophase, metaphase anaphase, telophase • Use a mod illustrate th role of cellu division (mitosis).		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 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.LS1.6.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.LS1.4-Use a model to illustrate the role of cellular division (mitosis)

• Cancer ma occur as a result of improper c division. • Stem cells undifferent cells. • During earl stages of developme cells differentiat specialize.		• Cell cycle regulation i necessary healthy gro • The cell cy highly regu and contro by a variety internal an external sig • Cancer is ca by uncontro cell growth c failure of cel cycle regula • Some asex organisms reproduce cell divisior • Binary fissi similar in process to mitosis. • During mito genetic information transferred chromoson from the pa cell to iden daughter c	• Develop a written or v explanation demonstra that offspri are not clo of their par or siblings to the meio processes independe assortment chromoson crossing ov and mutati • Compare a contrast th process of division in plants, ani and bacter • Relate the process of cancer formation t errors in th cycle. Predict a c response t certain checkpoint genes or g factors.		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.LS3.1.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)

		• The length cell's life cy varies dependent cell type ar environme conditions. • Fertilizatio restores th diploid chromoson number to cell. • Specialize cells made through differentiati perform sp functions. • Stem cell therapy ma used to tre certain dise • Gametes h half the nu of chromoson that body c have. • Humans ha cells that undergo m and those go through meiosis.	• Research ar communicat modern applications regulation o differentiatic analyze the benefits and (e.g., stem c sex determinatic • Recognize terminology specific fac and genera concepts related to c division, se reproductic organismal growth, differentiati during developme		(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)

		• During mei daughter c with geneti varied chromoson are formed • Body cells diploid; gar are haploid • During mei diploid cell undergo tw divisions th result in ha cells. • Haploid ce develop int mature gar for sexual reproductio • Independe assortment crossing ov during mei result in ge diversity. • Sexual reproductio creates uni gene combinatio	• Differentiate between: ◦ ◦ ◦ ◦ ◦ ◦ **Suggested Activities** • Onion Roo Mitosis Lab Whitefish Mitosis Lab • Cancer On Video and/ Research Project		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

			• Mitosis / Meiosis Compariso Poster, Vid or Flipbook • Online Mito Meiosis Compariso Webquest • Stem Cell V Assignmen		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)]
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: January/Week 20 - February/Week 23					
UNIT NAME: Nucleic Acids and Protein Synthesis					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• All cells contain genetic information in the form DNA molecules. • Heritable information provides for the continu life. • Genes are regions in th DNA that contain the instructions that code fo formation of proteins. • Different cells of the bo use different parts of th genetic code. • DNA is used as a templ to make other nucleic a in the process to make proteins. • Mutations are changes DNA sequence and are source of genetic variat • The proteins that are co for by DNA build and re cells and tissues and co metabolism.	• What is the structure of DNA molecule and how properties allow it to fun and replicate? • What is the structure of RNA molecule and how this compare to DNA? • How does the structure DNA encode information about making proteins? • How do the properties o RNA allow it to act as a messenger of genetic information? • How is genetic informati transferred through generations? • What is transcription an translation and where in cell do they occur? • What are genes? • How are genes express • What are different types mutations and how do th affect organisms?	• DNA struct the same i eukaryotic organisms. a double h molecule composed sugars, phosphate groups, an nitrogen ba • DNA is composed four types nucleotides order of wh determines organism's traits. • Watson an Crick deve an accurat model of D three-dimensiona structure. • Nucleotide always pai in the same	• Construct a label a mo that repres the structu DNA • Distinguish between str and function DNA and RN • Transcribe a piece of DN code into RN and then Translate a of mRNA co into a seque of amino aci using a Cod chart. • Sequence steps invol in DNA Replication referring to appropriate enzymes. • Sequence steps invol in transcrip and transla including th enzymes involved.		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 replic copies the genetic information cell during division. • Enzymes a involved in processes replication, transcriptio and transla • Transcripti converts a into a singl stranded R molecule. • RNA is sin stranded a differs from DNA in one its four nitr bases. RN serves as a template th carries ge information • Transcripti occurs in th nucleus an results in th types of R	• Use proper laboratory skills and tools to extract DNA from living cells. Measure and observe DNA collected. • Develop an explanation for how the same gene can be expressed differently and therefore result in a different protein. • Analyze gene mutations and predict the effect on specific polypeptides being made. • Investigate the effects of specific mutations and how they may lead to human disease. **Suggested Activities:** DNA Extraction Lab Chalkboard Manipulative Model - Transcription/ Translation DNA Puzzles Protein Synthesis Simulation Lab Genetic 'Secret Message' Decoding Activity Mutations Webquest		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.LS1.3.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.LS2.2.CNS.1-Most scientific knowledge is quite durable, but is, in

		• Translation occurs at th ribosomes converts an mRNA mes into a polypeptide protein. • Amino acid coded by a base pair mRNA sequence. • Amino acid linked by peptide bo to become protein. • Before mR finalized pi of DNA are removed (introns) an other piece (exons) are expressed.			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.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 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-

		• Mutations a changes in that may o not affect t protein bei made. The may includ frameshift mutations, mutations, chromoson mutations. • Genes are regions of that are expressed specific pr • Mutations be caused several fac including environme conditions, error durin replication.			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)] 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.LS3.2.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-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.LS3.3.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 Honors
Type : Consensus

Duration: February/Week 24 - April/Week 32					
UNIT NAME: Genetics and Genetic Engineering					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Offspring are not 'clone their parents, but a unic combination of genes. • Genes are units of information about herita traits which are passed down from parent to offspring. • Genes can come in diff forms. Most body cells l two versions of the sam gene. Sex cells have or version of a gene. • In sexual reproduction, offspring receive half of chromosomes from the father and half from the mother. • Physical and chemical characteristics of an organism is determined genes. • There are known patter inheritance which can b used to calculate the probability of certain tra occurring in the offsprin • Environmental factors a affect expression of trai and hence affect the probability of occurrenc traits in a population.	• How can w predict the phenotype future offsp based on t traits of the parents? • How is gene information characteristi one generat passed to th next? • Why do individuals c same family different combination traits? • What are genes and are they inherited? • How can th rules of probability applied to genetic problems?	• Gregor Mendel's research showed tha traits are inherited a distinct uni • Mendel's d revealed patterns of inheritance • Through se reproductio offspring in half of thei genetic information each paren • Genes enc proteins th produce a diverse ran traits.	• Evaluate th contributio Gregor Me to the field Genetics. Identify phenotype genotypes certain individuals determine probable outcome in variety of genetic cro • Describe ho genetics an environmen contribute to organism's physical trai • Simulate gamete production fertilization recombinat of genes to determine phenotype offspring through a l exercise		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.LS1.1.DCI.LS1.A.2-All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the 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.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

• Mutations can alter inheritance patterns wh may lead to diversity of species or disease. • Humans have been manipulating the genes organisms for many yea way of breeding and agricultural processes. • Genetic engineering inv isolating modifying and inserting genes back int same organism or into a different organism. • New genetic technologi raise social, ethical, leg and ecological question related to benefits vs ris	• How do gen mutations at an organism • What factors affect the expression of traits? • What is the difference between body cells and sex cells? How many copies of each gene are in these cells? • How can chromosomes be analyzed to predict genetic disorders? • How can inheritance patterns in families be studied? • How can DNA be manipulated and used in Biotechnology? • What are the current uses of DNA technology? • What are the ramifications of using DNA technology?	• The same can have n alternate versions (alleles). S alleles are considered 'dominant' others and block their expression Other allele interact in different wa • Human son cells have diploid chromoson number an copies of e gene while gametes ha haploid nu and one co each gene • The inherit of traits foll the rules of probability. • Punnett sq can be use predict the outcome of genetic cro	• Analyze a variety of autosomal inheritance patterns including complete dominance codominan incomplete dominance multiple all traits as we the inherita patterns of linked traits such as hemophilia colorblindn and muscu dystrophy.		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

		• A monohyb cross invol one trait; a dihybrid cr involves tw traits. • The chromoson on which g are locate affect the expressio traits. • There are t types of chromoson in the hum cell; autos and sex chromoson • Genes can linked and linkage ma affect expressio • Mutations be inherite found in gametes o parents.	• Determine probable outcome o genetic cr outcomes including monohybri dihybrid crosses; re outcomes i percentage fractions, a well as rati Predict the effects of g linkgage a gene interaction the phenot of an indivi • Analyze pedigrees determine inheritance pattern of a particular t Develop a accurate pedigree c based on provided phenotypic informatio		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.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.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

		• Phenotype affected by many differ factors suc gender, the environmer and the interaction different all • A karyotyp tool that ca used to pre chromoson disorders a gender. • Pedigrees be used to study inheritance patterns in families. Restriction enzymes a used to cut splice DNA forming recombina DNA. Electropho can be use sort DNA fragments size.	• Construct a analyze karyotypes determine gender and identify the presence c certain ger disorders caused by errors in meiosis.		science and engineering. (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.LS3.3.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.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

		• Scientists u various methods to copy, sort, recombine analyze DN from differe organisms. DNA Technologi have been useful in medicine, agriculture, engineerin industry, forensics a paternity testing. DNA Technology constantly changing a carries soc ethical and complicatio	• Differentiat between th following: ◦ ◦ ◦ ◦ ◦ ◦ Predict wh a specific mutation w inherited.		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)]

		• The source variations ar individuals c same specie within natura variations of genes, rand mutations in genetic mat crossing ove during meio and recombinati during fertili	• Recognize terminology specific fac and genera concepts related to gamete production DNA organizatio fertilization inheritance gene combinatio and analys patterns of inheritance certain trai and disord • Construct a model that simulates gene splicing and / or recombinant DNA. • Carry out an electrophoresis experiment and analyze the results. • Research various current methods in DNA Technology and communicate findings to the class. ◦ **Suggested Activities:**		

			Probability Lab Monohybrid & Dihybrid Cross Labs (Coins, Beads, Corn) Analyzing Pedigrees Lab Karyotype Labs PTC Taste Lab Human Inheritance Lab Mendel Ted Talk Streaming Video Constructing Recombinant DNA Lab Gel Electrophoresis Lab DNA Technology Research Projects		
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: May/Week 33 - May/Week 36					
UNIT NAME: Evolution					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
		• The work o Lyell, Walla Malthus, a other scien contributed our early understanc of evolution • Darwin prop natural sele as a mecha for evolution • Charles Dar voyage and subsequent research pr support for t Theory of N Selection • Evidence of common an among spec comes from sources suc comparative anatomy, biochemistry fossils, embryology, biogeograph	• Evaluate the contributions various scie to our understandi evolution. • Compare a Contrast Lamarck's a Darwin's the about natura selection. Analyze a v of biological evidence tha supports sp relatedness evolution. • Describe ho environment determines adaptations beneficial ar passed dow offspring.		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.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)]

		• Natural sele is one mech by which populations change over This include following premises: • natural selectio acts on existing variatio within popula • there a more offsprin produc than ca survive • resourc are lim leading compe • those organis with favorab traits a more li survive reprodu	• Describe se mechanisms which evolu occurs inclu mutation, migration, g drift, and na selection. • Communic others the process of natural sel using a rea world exam • Critique th scenarios written by others and a peer refle Recognize terminology specific fac and genera concepts related to adaptations natural selection, evidence o evolution, mechanism evolution, a biochemist it applies to evolution.		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.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

		• A populatio shares a co gene pool. T frequencies certain allele gene pool m increase or decrease ov time which r in evolutiona change. Populations individuals, (Speciation occur by va mechanism including sympatric, parapatric, allopatric speciation.	• Calculate a frequencies given popu and determ evolution is occurring. • Analyze a interpret multiple lin evidence supporting idea that al species are related by common ancestry su as molecul studies, co anatomy, biogeograp fossil recor and embry • Generate a analyze a model, suc a cladogra an evolutio tree, showi how a grou organisms most likely diverged fr common ancestry.		different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6) (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.LS3.3.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.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-

		• Population evolve in convergent divergent patterns. Phlyogene trees can b used to sh evolutionar relationship over time. Cladogran can be use analyze de and share traits. • New techno furthering ou understandi evolution. • Genetic vari in a populati increases th chance that individuals v survive.	• Construct a explanatio based on evidence fo how natura selection le to adaptati populations • Evaluate th evidence supporting claims that changes in environme conditions result in • increases i number of individuals some spec the emerge of new spe over time, the extincti other speci Construct timeline tha summarize changes in Earth's organisms time. **Suggested Activities:** Voyage of the Beagle Mapping Activity		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 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

		• Species can become exti Some extinc are due to th activities of humans suc habitat destruction climate char • Life on Earth began as sn simple organ in the ocean which later diversified a adapted to different environmen conditions.	Goldfish Natural Selection Lab Evolution Webquest & Simulations Natural Selection Game Human Hand Adaptation Lab Animal Evolution Research Project		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.LS4.3-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.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.LS4.3.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.LS4.4-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.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-Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS4.5.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-LS4-5) (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)] HS.LS4.5.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)]

• Population change ove time. The proce evolution d the diversit unity of life • There is a range of evidence fr various fiel science for process of evolution. All organis on Earth including humans, sh evolutionar history. • Natural selection is process of evolutionar change.	• What scien contributed our understanc of evolution processes? What is th significanc Charles Darwin's voyage and research? • What evider shows that different spe are related t each other a common ancestors? • How can evolution b used to exp the incredi biodiversity organisms Earth? • Through wh mechanisms organisms change over				

• Variation (c to mutation recombinat of genes) in populatio and provid the raw ma for evolutio • Genetic diversity wi the popula allows for reproductiv success in event of environm change. • A new spe may form a genetic cha increase. • Human activities ca influence evolution o species bo through ac upon the environme and directly through the manipulatio an organis DNA.	• What is natu selection? H does a popu change by w natural sele In what way alleles and a frequencies related to evolutionary change? • How does n selection encourage i and intraspe diversity ove time? • How does th process of speciation o • What are the different patterns of evolution se throughout geologic his • How can evolutionar evidence b used to arr organisms phylogenet tree?				

	• How are cladograms created an analyzed? do they sh evolutionar connection • How are hu activities impacting th evolution of species on E • How has life on Earth cha over time?				
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: May/Week 35 - June/Week 37					
UNIT NAME: Ecology and Interdependence					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Matter is changed a cycles thro the environ • Living thing interdepen and rely or each other their environme • Energy is transferred one level ir ecosystem another an some ener used or los each level. • Ecosystem have carryi capacities, which are l to the num of organism and popula they can support.	• How do living organism the chemicals that they to build their bodies? • What are the different components of an ecosystem? • What is the original sou of energy for most ecosystems? • What limits the growth of populations? • What types of growth ca population exhibit? • How and why do organism interact with their environn and what are the effects o these interactions? • What are several forms symbiotic relationships? • What does a food chain show? How does a food chain compare to a food web? • What are the different le and types of organisms food web?	• Ecology is study of the relationship among organisms their environme • Ecologists environme different le of organiza • Every ecosystem includes bo living (bioti and nonlivi (abiotic) fa • Changing factor in an ecosystem affect many other facto • Life in an ecosystem requires a source of energy.	• Describe th role of an ecologist a give examp of various a of ecologic study. Distinguish between al and biotic component an ecosyst Trace the of carbon molecules, oxygen, nitrogen, a water throughout ecosystem		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.LS1.6.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.LS1.7-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.DCI.LS1.C.1-A

• Population may be aff by many fa including environme changes, community interaction and limiting factors. • Biodiversity measure o number of different sp living in an and can be changed b formation c new specie the loss of species. • Changes in environme that are ca by human activity can disrupt an ecosystem threaten th survival of species.	• Why are there so few organisms at the top of energy pyramid as compared to the base? • What happens to the ar of energy available as energy is transferred fr one level to the next? • How are oxygen, carbon, nitrogen, and water cycle an ecosystem? • How are organisms ada to the environments the in? • What happens when ecosystems change? H do the communities in a newly created ecosyste evolve over time? • How have humans advers impacted biodiversity?	• Producers provide en for other organisms ecosystem Almost all producers obtain ene from sunlig • Food chain and food w model the f of energy i ecosystem • A food cha a model th shows a sequence feeding relationship from one organism t next.			s 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.LS2.4-Use a mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (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.LS2.4.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.LS2.4.DCI.LS2.B.1-Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small

		• A food web shows a complex network of interacting chains. The amou available e decreases one level o food chain the next, le the smalles amount of available e to the top l consumers • Carbon, oxygen, nitrogen, a water are c through an ecosystem through a variety of processes. • Pyramids r the distribu of energy a matter in a ecosystem			fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency , there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.4.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.LS2.5-Develop a

		• Every orga has a habit and niche. Organisms have a vari of adaptati that allow t to live & reproduce successfull their environmer These inclu camouflage mimicry, bo structure a physiology • Organisms interact as individuals as populati • Competitio predation, symbiosis all exampl ways in wh organisms interact.			model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.LS2.5.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5) (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.CCC.1-Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions — including energy , matter, and information flows—within

		• Symbiosis close relationshi between different species. Th include mutualism commensa parasitism, predation. • Changes in population' size are determined immigration births, emigration deaths.			and between systems at different scales. (HS-LS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] 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

		• Population growth is determined available resources, as nutrients water, and interactions such as competition parasitism. Population may show logistic or exponentia growth patt and these growth patt may be aff by limiting factors in t environme			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)] LS2.A-Interdependent Relationships in Ecosystems (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

		• Ecological succession process of change in t species tha make up a community Succession occurs follo • a disturban an ecosyst Devastated communitie terms of pr and secon succession progress differently time at diff rates. Human activities h profound e on species their environme The proces of climate change, pollution, h destruction hunting ha greatly impacted Earth's ecosystem			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.LS2.6-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.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)]

			• Predict hov specific changes in ecosystem affect the c members c ecosystem Analyze fo chains and webs of va communitie and identify trophic leve producers, types of consumers amount of energy at e level. Construct label an en pyramid fo particular ecosystem based on evidence. Observe a compare adaptations organisms describe ho they are we suited to th environme Identify the appropriate form of symbiotic		

			relationship shown bas available evidence. Hypothesi the possibl impact if or more of the organisms ecosystem experience population increase or decrease. • Provide examples o impacts of human acti on the environme and biodive • Analyze ar interpret da from experiment ecosystem where matt has been a or withdrav such as thr application fertilizer or during drou conditions.		

			• Use compu simulations analyze ho energy flov through tro levels. • Analyze different patterns of population growth and construct a graph of population growth bas on supplied data. Predi effect of a limiting fac population Investigate form of hur impact on t environmer and communica research findings wi class.		

			• Differentiat between: ◦ ◦ ◦ ◦ ◦ ◦ ◦ ◦		

			• Recognize terminology specific fac and genera concepts related to r and energy cycles, ecosystem interactions carrying capacities, ecological succession human imp on the environme **<u>Suggested Activities:</u>** Food Web/Food Chain Modeling Activities Food Chain Game Ecology Internet Activity / Online Tutorial Building Energy Pyramids Activity Cycles of Matter Manipulatives Activity Mark & Recapture Lab Simulation - Predator Prey Relationships Algae Growth & Limiting Factors Lab Symbiosis Card Game Population Growth Graphing Activity Ecological Issues - Case Study Review / Student Presentations Start a Recycling		

Title : Roxbury High School Biology Honors
Type : Consensus

			Program at Your School		
Plans:					

Title : Roxbury High School Biology Honors
Type : Consensus

Duration: June/Week 38 - June/Week 40					
UNIT NAME: Body Systems and Homeostasis					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
• Complex organisms are composed of systems o tissues and organs that together to meet the ne of the whole organism. • Feedback mechanisms maintain a living system internal conditions withi certain limits even as external conditions cha • Changes or defects to body cells and tissues may result in system malfunctions/disease.		• Specialized cells functio together in tissues, orga organ systems, and the whole organism. • The structure of body ti and organs is unique to particular task being accomplished. • Homeostasis is the regulation and maintena of the internal environm Different body systems together to achieve a common function. • Conditions within the bo must remain within a na range. • Negative feedback loop necessary for homeosta	• Know the levels of organization in an orga and provide examples a each level. • List and describe the ov structures and functions associated with each or system. • Differentiate between positive and negative feedback loops with reg to homeostatic balance • Discuss how two or mo body systems interact t promote health for the w organism. • Plan an investigation to provide evidence that feedback mechanisms maintain homeostasis.		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.LS1.1.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-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

		• The main body systems include nervous, circula respiratory, digestive, excretory, muscular, skeletal, reproductive, endocrine, integumenta and lymphatic. • Each body system is composed of specific or and tissues and contrib to the maintenance of homeostasis. • A disruption in homeost can be harmful and may lead to disease. • Mammals have many o and tissues in common.	• Recognize terminology, specific facts, and gene concepts related to leve organization, cell structu and function, and biochemistry as it relate organ systems and homeostasis. • Develop an explanation to how malfunctions in a organ can lead to disea within the organism. **Suggested Activities:** Diagramming the Human Body Systems Modeling the Structure of the Heart, Brain, Kidney etc Student Project on Feedback Mechanisms (Model, Poster, Video) Human Eye Dissection Rat Dissection Fetal Pig Dissection		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 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-LS1-3) (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)]

	• What a the fiv major levels organi within human body? • How d the structu body tissues organs affect functio • How d body systen interac mainta homeo • How d feedba mecha help achiev homeo				

	• What a the 11 major systen their m compo and th functio				
Plans:					