ROBBINSVILLE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

Science

Honors Biology

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Course Philosophy

Every individual develops intellectually a broad understanding of biology as a science, and about fundamental concepts and categories of biological science. On a global scale, students are encouraged to become responsible global citizens by discussing ways to protect the planet, solve environmental issues, and reduce the effects of climate change. Students work collaboratively and engage in the scientific process to investigate and apply their knowledge of fundamental concepts. All of these diverse endeavors are related to different facets of the discipline of biology.

Course Description

This course covers the scope and sequence requirements of a typical two-semester honors biology course. The curriculum includes an introduction of core biological concepts including biochemistry, cell biology, genetics, evolution, and ecology. This course focuses on developing and enhancing the core science practices of the Next Generation Science Standards. Emphasis in lectures is on constructing explanations of modern biology and using evidence to support scientific thought. Students engage in scientific inquiry, highlight careers in the biological sciences, and explore everyday applications of key biological concepts.

Core and Supplemental Instructional Materials

Core Materials	Supplemental Materials
• OpenStax Biology 2e Online Textbook	• National Center for Case Study Teaching

• Biozone Biology for NGSS Workbook	• Howard Hughes Medical Institute • Newsela • Gizmos: Explore Learning • NSTA Argument-driven Inquiry in Biology Workbook • Miller and Levine Biology Foundations Workbook • POGIL Activities for High School Biology

Social Emotional Learning Connections

Below are the five core SEL Competencies as outlined by CASEL, and examples of how each may be addressed within this curriculum

Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism.

Example 1: Students participate in class discussions and opinion writing on a variety of topics such as their impact on global climate change and/or class debate on bioethical issues.
Example 2: Students reflect on personal progress using reflective anonymous surveys to highlight strengths and areas of improvement.

Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals.

Example 1: The scientific process requires students to persevere and develop strategies to overcome obstacles in order to successfully test and execute their ideas.
Example 2: Through engagement in the scientific process, students develop strategies for managing emotions, thoughts, and behaviors.

Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.

Example 1: Students consider the thoughts, feelings, and perspectives of other cultures and backgrounds. Students consider the influence of these factors' on personal health, global health, research, and society.
Example 2: Students build awareness by learning about key themes in biology such as the unity and biodiversity in biology. Students demonstrate their learning through research and presentations.

Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.

Example 1: Students collaborate and communicate with peers as part of the scientific process.
Example 2: Students provide constructive criticism and positive feedback to peers about their scientific investigations.

Responsible decision-making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.

Example 1: Students and scientists rely on problem solving, critical thinking, and personal perspective when conducting scientific investigations.
Example 2: Students and scientists consider personal, ethical, safety, and civic impacts when making scientific decisions and drawing conclusions.

Integration of 21st Century Themes and Skills

NJSLS-CLKS 9.4: Life Literacies and Key Skills	
Creativity and Innovation	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 1, 3, 4, 6
Critical Thinking and Problem Solving	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 6
Digital Citizenship	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 4, 6
Global and Cultural Awareness	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 2, 6
Information and Media Literacy	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 6
Technology Literacy	*See specific standards and their connections/examples for this disciplinary concept listed within each individual unit* Can be found in unit: 1, 2, 3

Robbinsville Ready 21st Century Skill Integration

The following skills will be embedded throughout the curriculum and instruction of this course.

Collaborative Team Member: Robbinsville students will learn more by working together than in isolation. As educational theorist Lev Vygotsky advocated, learning is a social process. Many workplaces today encourage employees to work in teams to solicit diverse perspectives, brainstorm new ideas and/or products, and solve problems. Further, collaboration fosters interpersonal relationships, self-management skills, cooperation, and a sense of collective responsibility. Collaborative team members are able to work with diverse groups of people who hold a variety of perspectives.

Effective Communicator: Robbinsville students must be able to clearly articulate their ideas orally, in writing, and across various media in order to successfully connect to the world around them. As the world becomes increasingly globalized, communication is more than just sharing one's ideas. Effective communicators are able to communicate their convictions, actively listen and analyze others' work to identify perspective and/or potential bias.

Emotionally Intelligent Learner: Robbinsville students who are emotionally intelligent learn to be empathetic, demonstrate integrity and ethical behavior, are kind, are self-aware, willing to change, and practice self-care. They are better able to cope with the demands of the 21st century digital society and workplace because they are reliable, responsible, form stable and healthy relationships, and seek to grow personally and professionally. Emotionally intelligent people are able to manage their emotions, work effectively on teams and are leaders who can grow and help to develop others.

Informed and Involved Citizen: Robbinsville students need to be digital citizens who are civically and globally aware. The concept of what it means to be "literate" has evolved along with 21st century technological and cultural shifts. Our progressive vision of literacy entails having our students explore real world problems in the classroom. Informed and involved citizens are able to safely and accurately communicate with people all around the world and are financially, environmentally and informationally literate.

Innovative Thinker: Robbinsville students must encompass innovative thinking skills in order to be successful lifelong learners in the 21st century world. As stated by Karl Fisch and Scott McLeod in the short film Shift Happens, "We are currently preparing students for jobs that don't yet exist . . . using technologies that haven't been invented . . . in order to solve problems we don't even know are problems yet." Innovative thinkers are able to think analytically, solve problems critically, creatively engage in curiosity and tinkering, and demonstrate originality.

Resilient and Self-Directed Learner: Robbinsville students need to take risks and ultimately make independent and informed decisions in an ever-changing world. Author of Life, the Truth, and Being Free, Steve Maraboli stated, "Life doesn't get easier or more forgiving, we get stronger and more resilient." Self-directed scholars of the 21st century are able to set goals, initiate resolutions by seeking creative approaches, and adjust their thinking in light of difficult situations. Resilient students are able to take risks without fear of failure and overcome setbacks by utilizing experiences to confront new challenges. Resilient and self directed scholars will consistently embrace opportunities to initiate solutions and overcome obstacles.

Career Awareness and Planning Standards 9.2	
9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.	**Example:** Throughout the course, students are exposed to various careers in genetics, biotechnology, medicine, environmental science, and biotechnology.
9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.	**Example:** Students learn about various career and schooling pathways in science. Students can create and keep track of a personal plan of interest and action.
9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.	**Example:** Students will decide if their postsecondary plans will include the sciences, and if so, what next steps they may take to achieve them, including building a science portfolio, obtaining a summer internship, and/or volunteer opportunity.

Robbinsville Public Schools
Scope, Sequence, Pacing and Assessment

Honors Biology

Unit Title	Unit Understandings and Goals	Recommended Duration/ Pacing	Assessments
Unit 1: Foundations of Life and Science Practices	Provide a structural overview of biology including the core characteristics of life and an introduction to science practices. Plan and conduct investigations using proper vocabulary and experimental design in the scientific process to provide evidence that feedback mechanisms maintain homeostasis.	Sept. (2 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Color cards Summative · Characteristics of Life and Science Skills Unit Test Common Benchmark Assessments (mid/end of course) · N/A Alternative Assessments (projects, etc when appropriate) · Worm Lab · Design an experiment
Unit 2: Matter and Energy	Examine the importance of water to life processes through hands-on investigation and practices. Identify the building blocks of life. Describe how the bonds in food molecules can be broken/reform to create new compounds as a result of energy transfer. Model the importance of enzymes in biological chemical reactions.	Sept-Nov. (8-9 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Modeling, Discussions, 3-2-1, Misconception check, Color cards Summative · Water and Macromolecules Quiz · Enzymes and Cellular Respiration Quiz · Metabolism Unit Test Common Benchmark Assessments (mid/end of course) · N/A Alternative Assessments (projects, etc when appropriate) · Water Lab

	Construct explanations based on evidence for the cycling of matter and transformation of energy in various conditions (aerobic/anaerobic) through different metabolic pathways. Illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.		· Macromolecule Lab · Enzymes Lab · Cellular Respiration Lab · Photosynthsis Lab · Modeling cellular processes
Unit 3: Cells, Structure and Function	Examine the complex cellular level of biological organisms including the importance of cell and organelle specificity in multicellular organisms. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. Demonstrate the mechanisms used by organisms to maintain dynamic homeostasis. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. Investigate the effects of cellular mutations/malfunctioning on biological organisms including the causes, effects, and potential solutions for various types of cancers.	Dec-Jan (5-6 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Modeling, Discussions, 3-2-1, Misconception check, Color cards Summative · Cell Organelles Quiz · Transport Unit Test · Mitosis Quiz Common Benchmark Assessments (mid/end of course) · N/A Alternative Assessments (projects, etc when appropriate) · Cancer Case Study Project & Presentations · Microscope Lab · Transport Modeling · Transport Lab · Online lab simulations
Unit 4: DNA, Inheritance and Variation	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.	Jan-April (9-10 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Modeling, Discussions, 3-2-1, Misconception check, Color cards

	Examine the relationship between the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. 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. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.		Summative · Protein Synthesis Unit Test · Genetics Unit Test Common Benchmark Assessments (mid/end of course) · N/A Alternative Assessments (projects, etc when appropriate) · DNA Extraction Lab · Protein Synthesis Modeling · Genetic Disorder Project · Student Presentations · Class Debates
Unit 5: Natural Selection and Evolution	Investigate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. 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. 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.	April-May (3-4 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Modeling, Discussions, 3-2-1, Misconception check, Color cards Summative · Evolution Unit Test Common Benchmark Assessments (mid/end of course) · N/A Alternative Assessments (projects, etc when appropriate) · Online lab simulations · Modeling & Presentations · Case Studies

	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 (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. Discuss solutions to mitigate adverse impacts of human activity on biodiversity with focus on threatened or endangered species, or genetic variation of organisms for multiple species.		
Unit 6: Ecology	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. Examine the cycling of matter and flow of energy among organisms in an ecosystem. Evaluate the complex interactions in ecosystems to maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. Examples of	May-June (3-4 weeks)	Formative · Entrance Tickets, Exit Tickets, Think-Pair-Share, GoFormative, Quizizz main idea review, Modeling, Discussions, 3-2-1, Misconception check, Color cards Summative · Ecology Quiz Common Benchmark Assessments (mid/end of course) · End of the Year Cumulative Final Exam Alternative Assessments (projects, etc when appropriate) · My Backyard Ecology Project · Online lab simulations · Climate change research and presentations · Case Studies

	human activities include urbanization, building dams, and dissemination of invasive species. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.		

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Unit #1: Foundations of Life and Science Practices

Enduring Understandings:	**Essential Questions:**
● Scientists use logical scientific methods to solve problems. ● Experiments are designed using specific components ● Organisms share common characteristics of life. ● Science practices are rooted in specific skills of data collection and presentation	● What is biology? What are the characteristics of life? ● How do you design an experiment using the scientific method? ● What are the essential factors and vocabulary for proper experimental design? ● How do scientists gather, sort, and analyze data?

Interdisciplinary Connections

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
HSS-ID.A.1 Represent data with plots on the real number line.

Career/Real World Connections

Example: Students investigate the foundational concepts of biology as well as the skills required to conduct science practices. Students are exposed to various topics in biology as well as careers and career fields of interest throughout the course.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
HS-LS1-3	What is biology? What are the characteristics of life?	Identify and explore the characteristics of living organisms. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	*Sort and Classify* various objects as living, nonliving, once living, from something living Worm Experiment: Conduct an investigation for stimulus and response in an earthworm	Earthworms, Shells Feathers, Rocks, Sandpaper, Lemon Juice, Magnifying Glass	Lab Analysis Questions
SP 4	How do scientists gather, sort, and analyze data?	Create appropriate graphs based on given data. Practice various types of graphs (line, bar, double bar) in multiple formats (paper-pencil and computer generated).			

SP1	How do you design an experiment using the scientific method? What are the essential parts of a controlled experiment?	Ask questions and define problems. Design a controlled experiment, display data using appropriate graphing, draw conclusions based on evidence	Design your own plant experiment: Choose a factor that affects plant growth and homeostasis. Students will determine IV, DV, Constants, and Control. Analyze and interpret graphs. Create and construct various types of graphs using specific data.	Seeds, Soil, Pots, Light Source, Variables - Water, Light Distance, Wind, Type of Seed, Humidity, Temp, Etc.	Abbreviated Lab Report: Hypothesis, Data, Analysis, Discussion Communicate results with mini-presentation End of Unit Quiz, written assessment including open response and multiple choice

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Unit #2: Matter and Energy

Enduring Understandings:	**Essential Questions:**
● Water is an essential component for living organisms and the environment. ● Proteins, carbohydrates, nucleic acids, and lipids are the building blocks of life. ● Life emerges due to the chemical organization of matter into cells. ● Eukaryotic cells can differentiate and organize making it possible for multicellularity. ● Organisms obtain and use energy to carry out their life processes.	● Why is water crucial to life? ● How does life result from chemical structure and function? ● What role do enzymes play in living systems? ● How do different organisms obtain and use energy to survive in their environment? ● How do matter and energy move through an ecosystem? ● How does human activity impact the natural carbon cycle?

Interdisciplinary Connections

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.GCA.1: Collaborate with individuals, analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).

Career/Real World Connections

Example: Students explore the intricate balance of the carbon cycle and the impact of human activity on the global community. Students investigate the importance of water and food as fuel for living organisms as well as climate stability.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
HS-LS1-3	Why is water crucial to life?	Describe the unique properties of water and how these properties support life on Earth (*high specific heat, cohesion, adhesion, polarity, solubility, heat of vaporization, density*)	Mini-water lab to explore the various properties of water through hands-on investigation.	Pennies, Capillary Tubes. Soap, Food Coloring, Pipettes, Beakers, Celery, Balloons	Lab Analysis Questions
HS-LS1-6 HS-LS1-7	How does life result from chemical structure and function?	Explain how carbon is uniquely suited to form biological macromolecules Describe how biological macromolecules form from monomers.	Develop models to predict and show relationships. Model macromolecules and covalent bonds. Organic Compounds Lab Investigation: Identify chemical tests for carbohydrates, fats, and	Modeling Kits Glassware, Pipettes, Gelatin, Glucose, Sucrose, Oil	Group teacher Q/A, Student models, presentations, group discussions Abbreviated Lab Report:

SP2		Compare the structure and function of carbohydrates, lipids, proteins and nucleic acids in organisms	proteins. Identify an unknown substance.		Introduction, Data, Analysis, Discussion CheckPoint Quiz on Water and Macromolecules
9.4.12.TL.2 SP3	What role do enzymes play in living systems?	Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. Explain how factors such as pH, temperature, concentration, and salinity can affect enzyme function. Plan an investigation, individually or collaboratively, to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.	Enzyme Lab: Design a controlled experiment with one variable, collect and share class data using google sheets	Potatoes, Hydrogen Peroxide, Test Tubes, and other variables	Lab Report: Introduction, Hypothesis, Procedure, Data, Analysis, Discussion
HS-LS 2-3 HS-LS 1-5 SP2	How do different organisms obtain and use energy to survive in their environment?	Describe the role of ATP in biochemical reactions. Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Describe the role of chloroplasts and mitochondria in energy transformation.	Labeling diagrams Murder mystery case study: Cyanide Modeling matter transformation in cellular respiration and photosynthesis	Modeling Kits	Group teacher Q/A, Student models, presentations, group discussions
HS-LS 1-5 HS-LS 1-6 HS-LS 1-7 SP3	How do matter and energy move through an ecosystem?	Compare the basic transformation of matter and energy during photosynthesis and cellular respiration. Plan an investigation, individually or collaboratively, to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.	Cellular Respiration Lab: Conduct an investigation to observe the relationship between oxygen consumption and cellular respiration. Photosynthesis Lab: Conduct an investigation to determine how various factors affect the rate of photosynthesis.	Stop Watch, Bromothymol Blue, Straws Leaves, Microscope, Tape, and other variables	Abbreviated Lab Reports: Hypothesis, Data, Analysis, Discussion CheckPoint Quiz on Enzymes and Cellular Respiration

HS-LS 1-6 HS-LS 1-7 9.4.12. GCA.1	How does human activity impact the natural carbon cycle?	Describe the cycling of matter between living organisms as well as living organisms with their nonliving world. Discuss human impact on the carbon cycle. Collaborate and analyze a variety of potential solutions to climate change. Determine why solutions may work better than others (e.g., political. economic, cultural).	Carbon Cycle Lab: Model the relationship between photosynthesis and cellular respiration in the carbon cycle. Using digital media resources- analyze the causes, effects, and potential solutions to mitigate climate change.	Modeling Kits Clay/Playdough	Student opinion essays on climate change Unit Test on Carbon Cycle, Photosynthesis, and Cellular Respiration

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Unit #3: Cells, Structure and Function

Enduring Understandings:	**Essential Questions:**
● Cells have organized structures and systems necessary to support chemical reactions needed to maintain the living condition. ● Structure is related to function at all biological levels of organization. ● Cell efficiency can be examined by looking at the relationship between cell surface area and volume. ● Through a variety of mechanisms, organisms seek to maintain a biological balance between their internal and external environments. ● New cells arise from the division of pre-existing cells. ● Malfunctioning cellular structures can lead to disease and death in living systems.	● How do the structures of organisms enable life's functions? ● Why is cell specialization important to multicellular organisms? What are the benefits of multicellularity? ● How do organisms maintain a biological balance between their internal and external environments? ● What is the importance of surface area to volume ratios in cells? ● How do cells grow and reproduce?

Interdisciplinary Connections

9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.

Career/Real World Connections

Example: Students examine the various causes of cancer on living organisms including both genetic and environmental. Students explore and investigate current and potential treatments for cancer including proactive, healthy lifestyle choices to reduce risk.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
HS-LS 1-1 HS-LS 1-2	How do the structures of organisms enable life's functions? Why is cell specialization important to multicellular organisms? What are the benefits of multicellularity?	Systems of specialized cells within organisms help them perform the essential functions of life. Compare and contrast cellular structures and functions in prokaryotic and eukaryotic cells. Students will explain the relationship between structure and function of the cell components using a variety of representations.	Diagrams of organelles and cell types Modeling cell size Microscope Lab Investigation	Microscope, Microscope Slides Gizmos	Lab Analysis Questions Teacher-Student Q/A Group Discussions

		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-LS 1-3	What is the importance of surface area to volume ratios in cells? How do organisms maintain a biological balance between their internal and external environments?	Explore differences in cell size and the importance of SA-to-Volume ratios in determining cellular efficiency. Explain how organisms maintain homeostasis.	Surface Area to Volume Ratio Lab	Fisher Surface Area to Volume Cell Kits	Posters and Presentations
HS-LS 1-3 SP4 SP5	How do organisms maintain a biological balance between their internal and external environments?	Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell Compare the mechanisms that transport materials across the plasma membrane (i.e. passive transport - diffusion, osmosis, facilitated diffusion; and active transport – pumps, endocytosis, exocytosis) Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations Further explore and calculate surface area-to-volume ratios, solve tonicity problems	Investigate transport by observing how solute concentration affects the movement of water across a biological membrane *(Starch-Iodine Lab, Mystery Solutions Lab, Etc.)* Analyze and Interpret Data, Create graphs to visually represent data Use mathematical and computational thinking	Starch, Iodine, Beakers, Dialysis Tubing, Scales	Analysis Questions Lab Report: Introduction, Hypothesis, Data, Analysis, Discussion Unit Quiz on cellular organelles and transport

HS-LS 1-4 9.4.12. TL.2	How do cells grow and reproduce?	Illustrate the role of cellular division and differentiation in producing and maintaining complex organisms. Describe the events that occur during the cell cycle: interphase, nuclear division (i.e. mitosis), and cytokinesis Briefly describe how the cell cycle is regulated. Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.	Microscope Lab: Compare onion root tip and fish blastula cell cycle stages, collect and share class data using google sheets Modeling the cell cycle Cell Cycle Graphic Organizer	Microscope, Prepared microscope slides Pop Bead Kits	Lab Report: Introduction, Hypothesis, Data, Analysis, Discussion
HS-LS 1-2 NJSLS A.W7.	How does cancer impact living organisms?	Describe and interpret relationships between structure and function at various levels of biological organization (i.e. organelles, cells, tissues, organs, organ systems and multicellular organisms)	Multimedia videos about cancer Cancer Presentation	Computer and digital resources	Unit Quiz on cell division and cancer Cancer Project & Presentation, Student rubrics

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Unit #4: DNA, Inheritance and Variation

Enduring Understandings:	**Essential Questions:**
● Hereditary information in genes is inherited and expressed. ● DNA segments contain information for the production of proteins necessary for growth and functioning of cells. ● Sexual and asexual reproduction consist of benefits and disadvantages to the survival of a species. ● Environmental and genetic factors can alter the inheritance and expression of genes. ● Biotechnology has made a profound impact on society.	● What is the genetic information stored in our cells? ● How is the hereditary information in genes inherited and expressed? ● How does DNA control growth and function of cells? ● What are the advantages and disadvantages of sexual and asexual reproduction? ● How do mutations occur? How do mutations alter the expression of genes? ● What is the probability of offspring inheriting certain genes? ● How has genetic engineering and biotechnology altered society?
Interdisciplinary Connections **9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas** **9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content.** **NJSLSA.W7. Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.**	
Career/Real World Connections **Example: Students participate in discussions on pedigrees, disease, genetic disorders, and the role of genetic counselors to determine the probability of passing genetic diseases to their offspring.**	

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
HS-LS 3-1	What is the genetic information stored in our cells?	Discuss how 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. Explain the relationship between DNA, genes, alleles, and chromosomes and their roles in inheritance.	DNA Extraction Lab DNA Modeling/Poster for replication Color Coding	Strawberries, Ethanol, Soap, Salt, Beakers, Funnels, Cheesecloth Modeling Kits	Lab Analysis Questions

HS-LS 1-4	How is the hereditary information in genes inherited? What are the advantages and disadvantages of sexual and asexual reproduction?	Examine the role of cellular division and differentiation in producing and maintaining complex organisms. Compare various types of reproduction in living organisms *(mitosis, meiosis, and binary fission)* Describe how the process of DNA replication results in the transmission and/or conservation of genetic information	T-Chart to compare sexual and asexual reproduction, pros/cons Venn Diagram of mitosis, meiosis, and binary fission Pop Bead or Clay Modeling of meiosis Modeling of DNA Replication	Clay Playdough Construction paper Crayons/Markers Popbeads	Class and group discussions Small group presentations of models
HS-LS 3-1 SP2	How is the hereditary information in genes expressed? How does DNA control growth and function of cells?	Examine the process of transcription and translation in prokaryotic and eukaryotic organisms. Describe how the processes of transcription and translation are similar and different in all organisms.	Modeling Central Dogma Relay Race Practice Coding from DNA to Protein	Modeling Kits	Group presentations or multimedia video presentations Small group presentations of models
HS-LS 3-2	How do mutations occur? How do mutations alter the expression of genes?	Describe how genetic mutations alter the DNA sequence and may or may not affect proteins/phenotypes (*e.g. silent, nonsense, missense, frame-shift*) Describe processes that can alter composition or number of chromosomes (*i.e. crossing-over, nondisjunction, duplication, translocation, deletion, insertion,and inversion*)	Identify the type of mutations using diagrams of DNA sequences. Multimedia videos and classroom discussions on mutations from altered protein structures including albinism, cystic fibrosis, etc. Research and investigate genetic disorders (*huntingtons, tay sachs, hemophilia, colorblindness, etc.)* by creating a report or completing DNA Detectives karyotyping boards	DNA Detectives Kit Computer and digital resources	Essay Practice worksheets Unit Quiz on the Central Dogma of Molecular Biology
HS-LS 3-2 HS-LS 3-3	What is the probability of offspring inheriting certain genes?	Variation and distribution of traits observed depends on both genetic and environmental factors. Describe and/or predict observed patterns of inheritance (*i.e. dominant, recessive, codominance, incomplete*	Solve genetic scenarios using probability and punnett squares Baby Genes Lab: Students using paper modeling to cross two	Carolina Biological Kits	Class participation and discussions Lab Analysis Questions

SP5		*dominance, sexlinked, polygenic, and multiple alleles*) Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units.	parents with various traits to create an offspring		
9.4.12. DC.1	How has genetic engineering and biotechnology altered society?	Explain how genetic engineering has impacted the field of medicine, forensics, and agriculture (*e.g. selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy*) Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content.	Discuss privacy laws and rights in regards to websites such as 23andme for collecting genetic data from customers Webquest to investigate pros/cons of biotechnology in various fields Small Group Debates	N/A	Debate rubrics, class participation Unit Quiz on Genetics

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Unit #5: Natural Selection and Evolution

Enduring Understandings:	**Essential Questions:**
● There is profound evidence to support the theory of evolution across all domains of life. ● Evolution is the result of many random processes selecting for the survival and reproduction of a population. ● Natural selection describes how organisms best suited for their environment will survive, reproduce, and pass on traits to their offspring. ● Adaptations are traits that allow for survival and reproduction in a population. ● Environmental factors can alter allele frequency and gene pools in a population. ● Human activity can alter the survival of organisms.	● How do we scientifically explain the evidence and mechanisms for biological evolution? ● What evidence shows that different species are related? ● What factors contribute to the process of evolution? ● What environmental aspects can lead to changes in a population's gene pool? ● How does human activity impact the emergence of new species and extinction of other species? ● How can humans work to mitigate their impact on biodiversity?

Interdisciplinary Connections

RST-11.12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies.
WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, and trying a new approach. Focusing on addressing what is most significant for a specific purpose and audience.
WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

Career/Real World Connections

Example: Students are introduced to the career of an evolutionary biologist and the wide range of topics that fall under this career from conservation, natural resource management, infectious disease, and environmental consulting.

Guiding / Topical Questions with Specific Standards	**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**

HS-LS 4-1 SP6	How do we scientifically explain the evidence and mechanisms for biological evolution? What evidence shows that different species are related?	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. Interpret evidence supporting the theory of evolution (*i.e. fossil, anatomical, physiological, embryological, biochemical, and universal genetic code*). Observe organisms from various groups and identify structures as homologous structures/analogous structures and connect structures with convergence /divergence. Defend your claim. Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena.	Evaluate the evidence that supports the theory of biological evolution using data sets, diagrams, multimedia, and online simulations. Examine and construct phylogenies to show speciation and relatedness.	Gizmos Computer and digital resources Various Beans, Spoons, Clothespins, Timer	Essays, Short writing prompts Phylogeny Diagrams
HS-LS 4-2 HS-LS 4-3 SP4	What factors contribute to the process of evolution?	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. 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.	Analyze and interpret mathematical models and graphs as evidence of factors contributing to natural selection using computer and class generated data through online simulations and data sets *(Deer/Wolf, Peppered Moth, Etc.)*. Use multimedia to explore evolutionary biology; for example to examine the biology behind scent and pheromones.	Gizmos Computer and digital resources	Online Lab Analysis Questions Case Studies Class participation and discussions

HS-LS 4-4	What environmental aspects can lead to changes in a population's gene pool?	Construct an explanation based on evidence for how natural selection leads to adaptation of populations. Use data for evidence (*changes to seasonal temperatures, climate change, acidification, light availability, geographic barriers*) of changes to gene frequency leading to adaptation of populations.	Model adaptations and survival benefits using fictitious scenarios and multimedia videos. Have students complete writing prompts and class discussions. Use multimedia to examine current trends in evolution including multidrug resistant bacteria.	Gizmos Carolina Biological Kits	Online lab analysis questions Case Studies Class participation and discussions
HS-LS 4-5 HS-LS 4-6	How does human activity impact the emergence of new species and extinction of other species? How can humans work to mitigate their impact on biodiversity?	Examine the relationship for how changes to the environment such as artificial selection, deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species. Create or revise a solution to mitigate adverse impacts of human activity on biodiversity related to threatened or endangered species, or to genetic variation of organisms for multiple species.	Group Discussions of multimedia and current events Online Simulations	Gizmos Computer and digital resources	Case Studies Simulation analysis questions Presentations of current event articles on endangered/ threatened species. Unit Test on Evolution

Robbinsville Public Schools

Unit #6: Ecology

Enduring Understandings:	**Essential Questions:**
● Organisms on Earth interact and depend in a variety of ways on other living and nonliving things in their environments. ● Organisms obtain and use energy to carry out their life processes. ● Matter cycles through an environment while energy has a one way flow. ● Complex interactions in an ecosystem help to maintain stability. ● Ecosystems change in response to human activity. ● Humans can work to reduce their impact on the environment and biodiversity through a variety of methods and approaches.	● How are ecosystems organized? ● How are the components of an ecosystem connected? ● How do organisms interact with the living and nonliving environments to obtain matter and energy? ● How does matter move through an ecosystem? ● How does energy move through an ecosystem? ● How do ecosystems change in response to human activities? ● How can humans reduce their impact on the environment and biodiversity?

Interdisciplinary Connections

Mathematical Practice 4 Model with mathematics
Mathematical Practice 2 Reason abstractly and quantitatively
HSS-ID.A.1 Represent data with plots on the real number line.
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from the population.
RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RST.11-12.7 Integrate or evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.
9.4.12.CT.3: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (e.g., political. economic, cultural).
9.4.12.CI.1: Demonstrate the ability to reflect, analyze and use creative skills and ideas

Career/Real World Connections

Example: Students will focus on understanding real world environmental problems and work to develop solutions to climate change, decreased biodiversity, and increase sustainability practices.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
HS-LS 2-4	How are ecosystems organized?	Describe the levels of ecological organization (*i.e. organisms, population, community, ecosystem, biome, and biosphere*)	Create an ecosystem powerpoint presentation with pictures and information to display understanding of ecology vocabulary and concepts	Camera Computer and digital resources	Ecosystem Project

	How are the components of an ecosystem connected?	Describe characteristics of biotic and abiotic components in aquatic and terrestrial ecosystems. Construct and revise explanations about the interconnected relationship between the living and nonliving parts of an ecosystem.			
HS-LS 2-3 HS-LS 2-4	How do organisms interact with the living and nonliving environments to obtain matter and energy?	Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively stable conditions (*group behaviors, competition, predation, symbiosis, keystone species, etc*)	Online Lab Simulations Analyze data on predator/prey relationships, Construct graphs Multimedia videos on the impact of keystone species *(The Wolves of Yellowstone)*	Gizmos Computer and digital resources	Graphing analysis Lab Report Classroom Discussions Small group Q/A
HS-LS 2-4 HS-LS 2-5	How does matter move through an ecosystem?	Describe how matter recycles through an ecosystem (*i.e. water cycle, carbon cycle, oxygen cycle, and nitrogen cycle*).	Online Lab Simulations Multimedia videos on biogeochemical cycles as well as human impact on the cycles Diagram cycles and label components	Gizmos Computer and digital resources	Small group Q/A Writing prompts Case Studies
HS-LS 2-4 HS-LS 2-5	How does energy move through an ecosystem?	Describe how energy flows through an ecosystem (*e.g. food chains, food webs, energy pyramids*)	Construct food webs and predict consequences to changes in food webs from extinctions, imbalance of predator/prey, and invasive species.	Poster Board	Posters and writing prompts Class and small group discussions
HS-LS 2-6 9.4.12. GCA.1 9.4.12. IML.5	How do ecosystems change in response to human activities?	Describe how ecosystems change in response to natural and human disturbances (*e.g. climate change, introduction of nonnative species, pollution, fires, flooding, urbanization, hunting, dams*)	Use various types of multimedia to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender and age diversity. Discuss sources and potential solutions. Collaboration with individuals in the problem-solving process,	Carolina Biological Kits including kits about multi-drug resistance	Video presentations or poster on invasive species Writing prompts on climate change Case Studies

9.4.12. IML.6 SP4 SP6			particularly for global issues where diverse solutions are needed. Evaluate, synthesize and apply information on climate change from various sources appropriately. Compare and contrast various types of data sets (*e.g., self-generated, archival*). Collaborate with individuals analyze a variety of potential solutions to climate change effects and determine why solutions may work better than others (*e.g., political. economic, cultural*).		
HS-LS 2-7 9.4.12. DC.8	How can humans reduce their impact on the environment and biodiversity?	Design and discuss solutions to reduce the impact of human activities on the environment and biodiversity. Examine how technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change. Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.	Research and investigate a specific type of human impact on the environment. Students will examine the cause, effect, and discuss potential solutions for the problem.	Computer and digital resources	Human Impact Project and/or Presentation Ecology Unit Quiz

General Differentiated Instruction Strategies	
• Leveled texts • Chunking texts • Choice board • Socratic Seminar • Tiered Instruction • Small group instruction • Guided Reading • Sentence starters/frames • Writing scaffolds • Tangible items/pictures • Adjust length of assignment	• Repeat, reword directions • Brain breaks and movement breaks • Brief and concrete directions • Checklists for tasks • Graphic organizers • Assistive technology (spell check, voice to type) • Study guides • Tiered learning stations • Tiered questioning • Data-driven student partnerships • Extra time

Possible Additional Strategies for Special Education Students, 504 Students, At-Risk Students, and English Language Learners (ELLs)			
Time/General	**Processing**	**Comprehension**	**Recall**
• Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for reports and projects • Communication system between home and school • Provide lecture notes/outline	• Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Reading partners	• Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning	• Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers
Assistive Technology	**Assessments and Grading**	**Behavior/Attention**	**Organization**
• Computer/whiteboard • Tape recorder • Spell-checker • Audio-taped books	• Extended time • Study guides • Shortened tests • Read directions aloud	• Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback	• Individual daily planner • Display a written agenda • Note-taking assistance • Color code materials

Enrichment

The goal of Enrichment is to provide learners with the opportunity to participate in extension activities that are differentiated and enhance the curriculum. All enrichment decisions will be based upon individual student needs.

- Show a high degree of intellectual, creative and/or artistic ability and demonstrate this ability in multiple ways.
- Pose questions and exhibit sincere curiosity about principles and how things work.
- The ability to grasp concepts and make real world and cross-curricular connections.
- Generate theories and hypotheses and pursue methods of inquiry.
- Produce products that express insight, creativity, and excellence.
- Possess exceptional leadership skills.

- Evaluate vocabulary
- Elevate Text Complexity
- Inquiry based assignments and projects
- Independent student options
- Tiered/Multi-level activities
- Purposeful Learning Center
- Open-ended activities and projects
- Form and build on learning communities
- Providing pupils with experiences outside the 'regular' curriculum
- Altering the pace the student uses to cover regular curriculum in order to explore topics of interest in greater depth/breadth within their own grade level
- A higher quality of work than the norm for the given age group.
- The promotion of a higher level of thinking and making connections.
- The inclusion of additional subject areas and/or activities (cross-curricular).
- Using supplementary materials in addition to the normal range of resources.

English Language Learner (ELL) Resources

- Learning style quiz for students- http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml
- "Word clouds" from text that you provide-http://www.wordle.net/
- Bilingual website for students, parents and educators: http://www.colorincolorado.org/
- Learn a language for FREE-www.Duolingo.com
- Time on task for students-http://www.online-stopwatch.com/
- Differentiation activities for students based on their Lexile-www.Mobymax.com
- WIDA-http://www.wida.us/
- Everything ESL - http://www.everythingESL.net
- ELL Tool Box Suggestion Site http://www.wallwisher.com/wall/elltoolbox
- Hope4Education - http://www.hope4education.com
- Learning the Language http://blogs.edweek.org/edweek/learning-the-language/
- FLENJ (Foreign Language Educators of NJ) 'E-Verse' wiki: http://www.flenj.org/Publications/?page=135
- OELA - http://www.ed.gov/offices/OBEMLA
- New Jersey Department of Education- Bilingual Education information http://www.state.nj.us/education/bilingual/

Special Education Resources

- Animoto -Animoto provides tools for making videos by using animation to pull together a series of images and combining with audio. Animoto videos or presentations are easy to publish and share. https://animoto.com
- Bookbuilder -Use this site to create, share, publish, and read digital books that engage and support diverse learners according to their individual needs, interests, and skills. http://bookbuilder.cast.org/
- CAST -CAST is a non-profit research and development organization dedicated to Universal Design for Learning (UDL). UDL research demonstrates that the challenge of diversity can and must be met by making curriculum flexible and responsive to learner differences. http://www.cast.org
- CoSketch -CoSketch is a multi-user online whiteboard designed to give you the ability to quickly visualize and share your ideas as images. http://www.cosketch.com/
- Crayon -The Crayon.net site offers an electronic template for students to create their own newspapers. The site allows you to bring multiple sources together, thus creating an individualized and customized newspaper. http://crayon.net/ Education Oasis -Education Oasis offers a collection of graphic organizers to help students organize and retain knowledge – cause and effect, character and story, compare and contrast, and more! http://www.educationoasis.com/printables/graphic-organizers/
- Edutopia -A comprehensive website and online community that increases knowledge, sharing, and adoption of what works in K-12 education. We emphasize core strategies: project-based learning, comprehensive assessment, integrated studies, social and emotional learning, educational leadership and teacher development, and technology integration. http://www.edutopia.org/
- Glogster -Glogster allows you to create "interactive posters" to communicate ideas. Students can embed media links, sound, and video, and then share their posters with friends. http://edu.glogster.com/?ref=personal
- Interactives – Elements of a Story -This interactive breaks down the important elements of a story. Students go through the series of steps for constructing a story including: Setting, Characters, Sequence, Exposition, Conflict, Climax, and Resolution. http://www.learner.org/interactives/story/index.html
- National Writing Project (NWP) -Unique in breadth and scale, the NWP is a network of sites anchored at colleges and universities and serving teachers across disciplines and at all levels, early childhood through university. We provide professional development, develop resources, generate research, and act on knowledge to improve the teaching of writing and learning in schools and communities. http://www.nwp.org
- Pacecar -Vocab Ahead offers videos that give an active demonstration of vocabulary with audio repeating the pronunciation, definition, various uses, and synonyms. Students can also go through flash cards which give a written definition and visual representation of the word. http://pacecar.missingmethod.com/