

**ROBBINSVILLE PUBLIC SCHOOLS**

**OFFICE OF CURRICULUM AND INSTRUCTION**

**SCIENCE DEPARTMENT**

**AP Biology**

**Board of Education**

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**BOARD OF EDUCATION INITIAL ADOPTION DATE:**

## Course Philosophy

Every individual develops the intellectual skills of inquiry and reasoning along with a balanced breadth of content and depth of knowledge in the biological sciences. Students will actively participate in the science process by developing investigations to answer essential questions as well as evaluating, sharing, and communicating scientific conclusions with their peers. Moreover, students will thoughtfully and independently interpret and apply biological concepts to various proposed hypotheses and real-world scenarios.

## Course Description

AP Biology is an introductory college-level biology course. The College Board curriculum includes two essential components - science practices and course content. This framework allows students to cultivate their understanding of biology through inquiry-based investigations while developing skills such as designing a plan for collecting data, analyzing data, applying mathematical routines, and justifying arguments using evidence. AP Biology students will study the core scientific principles, theories, and processes that govern living organisms and biological systems including the following topics: evolution, cellular processes, energy and communication, genetics, information transfer, ecology, and interactions. The result of this course will be the readiness for the student to approach advanced topics in subsequent college courses.

## Core and Supplemental Instructional Materials

Core Materials	Supplemental Materials
<ul style="list-style-type: none"><li>● AP Biology Lab Manual</li><li>● AP Biology CED</li><li>● Campbell and Reece AP Biology Textbook, Edition 10</li></ul>	<ul style="list-style-type: none"><li>● Online College Board Classroom</li><li>● National Center for Case Study Teaching</li><li>● Online Videos: Bozeman, Crash Course</li><li>● Virtual Labs: HHMI</li></ul>

## Integration of 21st Century Themes and Skills

### Educational Technology

#### Standards: (8.1.12.A.4, 8.1.12.F.1)

- **Technology Operations and Concepts 8.1.12.A.4:** Students demonstrate a sound understanding of technology concepts, systems and operations. Students construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.

**Example:** Students often work on collaborative platforms such as Google to share class data from classroom investigations. This allows data to be readily available for large group comparison and analysis. Students interpret the data to create graphs and/or tables to convey the results of their tested hypotheses.

- **Critical thinking, problem solving, and decision making 8.1.12.F.1:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

**Example:** Students participate in Socratic Seminars to analyze various points of view on a specific bioethical topics usually based around the emerging fields of biotechnology or infectious disease. Students research and debate various points of view to argue and evaluate consequences on local and global populations.

## Career Ready Practices

### Standards: (CRP1, CRP4)

- **CRP1.** Act as a responsible and contributing citizen and employee. Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

**Example:** Students will demonstrate the responsibilities associated with being a member of a community when engaging collaboratively and participating in whole group discussions. Examples may include peer review of lab reports and peer critique of student presentations.

- **CRP4:** Communicate clearly and effectively and with reason. Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

**Example:** Students will demonstrate communication skills through written lab reports, modeling activities in class, and presentations of posters and lab results. Students will use course rubrics to master the skills of accurate scientific writing in their lab reports as well as practice presenting scientific results to their peers. Students will work to actively listen to their peers and provide them with positive feedback and constructive criticism using online forms.

## 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.

**Robbinsville Public Schools**  
**Scope, Sequence, Pacing and Assessment**  
**AP Biology**

Unit Title	Unit Understandings and Goals	Recommended Duration/ Pacing	Assessments			
			Formative	Summative	Common Benchmark Assessments (mid-course and end of course <u>only</u> )	Alternative Assessments (projects, etc. when appropriate)
Chemistry of Life	<p>SYI-1: Living systems are organized in a hierarchy of structural levels that interact.</p> <p>IST-1: Heritable information provides for continuity of life.</p>	3-5 Classes	Personal Progress Check 1 via Collegeboard Classroom, Multiple Choice and Free Response	Water CER, Unit Exam	N/A	N/A
Cell Structure and Function	<p>SYI-1: Living systems are organized in a hierarchy of structural levels that interact.</p> <p>ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</p> <p>ENE-2: Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.</p> <p>EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.</p>	9-11 Classes	Personal Progress Check 2 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	Organelle Speed Dating Project

Cellular Energetics	<p>ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</p> <p>SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</p>	12-14 Classes	Personal Progress Check 3 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	N/A
Cell Communication and Cell Cycle	<p>IST-3: Cells communicate by generating, transmitting, receiving, and responding to chemical signals.</p> <p>ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.</p> <p>IST-1: Heritable information provides for continuity of life.</p>	7-9 Classes	Personal Progress Check 4 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	Cell Communication and Malfunction Poster Project
Heredity	<p>IST-1: Heritable information provides for continuity of life.</p> <p>EVO-2: Organisms are linked by lines of descent from common ancestry.</p> <p>SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</p>	7-9 Classes	Personal Progress Check 5 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	Genetic Disorder Project

Gene Expression and Regulation	<p>IST-1: Heritable information provides for continuity of life.</p> <p>IST-2: Differences in the expression of genes account for some of the phenotypic differences between organisms.</p> <p>IST-4: The processing of genetic information is imperfect and is a source of genetic variation.</p>	16-18 Classes	Personal Progress Check 6 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	Gene Switch Modeling Project
Natural Selection	<p>EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.</p> <p>EVO-2: Organisms are linked by lines of descent from common ancestry.</p> <p>EVO-3: Life continues to evolve within a changing environment.</p> <p>SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions within the environment.</p>	18-20 Classes	Personal Progress Check 7 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	N/A	N/A
Ecology	<p>ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.</p> <p>IST-5: Transmission of information results in changes within and between biological systems.</p> <p>ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</p> <p>SYI-1: Living systems are organized in a</p>	16-18 Classes	Personal Progress Check 8 via Collegeboard Classroom, Multiple Choice and Free Response	Lab Report, Lab Poster Presentations, Unit Exam	Final Cumulative Exam	N/A

	<p>hierarchy of structural levels that interact.</p> <p>ENE-4: Communities and ecosystems change on the basis of interactions among populations and disruptions to the environment.</p> <p>SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</p> <p>EVO-1: Evolution is characterized by change in the genetic make-up of a population over time and is supported by multiple lines of evidence.</p>					
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## Robbinsville Public Schools

### Unit # 1: Chemistry of Life

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● SYI-1: Living systems are organized in a hierarchy of structural levels that interact.</li> <li>● IST-1: Heritable information provides for continuity of life.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>● What is the role of energy in the making and breaking of polymers?</li> <li>● How do living systems transmit information in order to ensure their survival?</li> <li>● How would living systems function without the polarity of the water molecule?</li> </ul>
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#### Interdisciplinary Connection

Math: Quantities - A. Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Creating Equations - A. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. Students will use their mathematical skills to solve water potential word problems and solve for missing variables.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
1.1	Structure of Water and Hydrogen Bonding	2.A Describe the characteristics of a biological concept, process, or model represented visually.	Graph and Switch, Independent Notes, Guided Lecture	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Water CER
1.2	Elements of Life	2.A Describe the characteristics of a biological concept, process, or model represented visually.	Structure Form/Function Matching	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Online Quizizz
1.3	Introduction to Biological Macromolecules	2.A Describe the characteristics of a biological concept, process, or model represented visually.	Index Card Summaries/Questions	AP Lab Manual	Macromolecules Lab Report

1.4	Properties of Biological Molecules	1.A Describe biological concepts and/or processes.	Think-Pair-Share	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Kahoot Review
1.5	Structure and Function of Macromolecules	6.E.b Predict the cause or effect of a change in, or distribution to, one or more components in a biological system based on a visual representation of a biological concept, process, or model.	Think-Pair-Share	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Kahoot Review
1.6	Nucleic Acids	2.A Describe the characteristics of a biological concept, process, or model represented visually.	Think-Pair-Share	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response

## Robbinsville Public Schools

### Unit #2: Cell Structure and Function

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● SYI-1: Living systems are organized in a hierarchy of structural levels that interact.</li> <li>● ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</li> <li>● ENE-2: Cells have membranes that allow them to establish and maintain internal environments that are different from their external environments.</li> <li>● EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.</li> </ul>	<p><b>Essential Questions</b></p> <ul style="list-style-type: none"> <li>● How did eukaryotic cells originate?</li> <li>● How do the mechanisms for transport across membranes support energy conservation?</li> <li>● What are the advantages and disadvantages of cellular compartmentalization?</li> <li>● How are living systems affected by the presence or absence of subcellular components?</li> </ul>
<p><b>Interdisciplinary Connection</b></p> <p>Math: Interpreting Categorical and Quantitative Data - A. Summarize, represent, and interpret data on a single count or measurement variable. Represent data with plots on the real number line (dot plots, histograms, and box plots). C. Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. Students will use data collected in the lab to calculate rate of change in tonicity as well as interpret that data to create appropriate graphs and visuals for their lab reports.</p>	

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
2.1	Cell Structure and Subcellular Components	1.A Describe biological concepts and/or processes	Ask the Expert, Organelle Dating Speed Rounds, Lecture, Independent Notes	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	AP Practice Quiz
2.2	Cell Structure and Function	6.A Make a scientific claim.	Ask the Expert, Organelle Dating Speed Rounds, Lecture, Independent Notes	Carolina Magnetic Water Molecules, Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Google Form Self-Reflection

2.3	Cell Size	<p>2.D.a Represent relationships within biological models, including mathematical models.</p> <p>5.A.d Perform mathematical calculations, including ratios.</p>	Cell size and volume comparison lab	AP Lab Manual	Cell Size Lab Write-Up, Misconception Check
2.4	Plasma Membrane	2.A Describe characteristics of a biological concept, process, or model represented visually.	Practice FRQ Writing, Timed	AP Lab Manual	Transport Lab Report
2.5	Membrane Permeability and Transport	<p>3.D Make observations or collect data from representations of laboratory setups or results.</p> <p>5.D.b Use data to evaluate a hypothesis (or prediction) including supporting or refuting the alternative hypothesis.</p> <p>3.E.b Propose a new/next investigation based on an evaluation of the design/methods.</p> <p>6.E.b Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on a visual representation of a biological concept, process, or model.</p>	Practice FRQ Writing, Timed	AP Lab Manual	Transport Lab Report
2.6	Tonicity and Osmoregulation	<p>4.A Construct a graph, plot, or chart.</p> <p>1.B Explain biological concepts and/or processes.</p>	Practice FRQ Writing, Timed	AP Lab Manual	Transport Lab Report

2.7	Cell Compartmentalization	6.E.a Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on a biological concept, process, or model.	Turn and Talk, Think/Pair/Share	AP Campbell Textbook	Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response
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Robbinsville Public Schools

Unit #3: Cellular Energetics

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</li> <li>● SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</li> </ul>	<p><b>Essential Questions</b></p> <ul style="list-style-type: none"> <li>● How is energy captured and then used by a living system?</li> <li>● How do organisms use energy or conserve energy to respond to environmental stimuli?</li> </ul>
<p><b>Interdisciplinary Connection</b></p>	
<p>Math: Interpreting Categorical and Quantitative Data - A. Summarize, represent, and interpret data on a single count or measurement variable. Represent data with plots on the real number line (dot plots, histograms, and box plots). Making Inferences and Justifying Conclusions - B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. Students will collect and analyze class data from student-designed experiments. Students will use their graphing and statistical analysis skills to interpret and present their findings.</p>	

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
3.1	Enzyme Structure	1.B Explain biological concepts and/or processes.	Modeling with pool noodles and chalk paint	AP Lab Manual	Student model presentation, Enzyme Lab Report
3.2	Enzyme Catalysis	3.C.b Identify experimental procedures that are aligned to the question, including identifying appropriate controls.  3.C.c Identify experimental procedures that are aligned to a question, including justifying appropriate controls.	QuickWrite	AP Lab Manual	Enzyme Lab Report
3.3	Environmental Impacts on Enzyme Function	6.E.c Predict the cause or effect of a change in, or disruption to, one or more components in a biological system based on data.	Free Response Practice	AP Lab Manual	Enzyme Lab Report

3.4	Cellular Energy	6.C Provide reasoning to justify a claim by connecting evidence to biological theories.	Free Response Practice	College Board secure assessments	Peer grade and review
3.5	Photosynthesis	6.B Support a claim with evidence from biological principles, concepts, processes, and/or data.	Graph and Switch, Structured and Open Lab Inquiry, Killing Chloroplasts Case Study, Fall Picnic Case Study	AP Lab Manual, Buffalo Case Studies	Photosynthesis Lab Report and Presentations
3.6	Cellular Respiration	4.A Construct a graph, plot, or chart.	Graph and Switch, Structured and Open Lab Inquiry	AP Lab Manual	Respiration Lab Report and Presentation
3.7	Fitness	6.C Provide reasoning to justify a claim by connecting evidence to biological theories.	Misconception Check	N/A	Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response

Robbinsville Public Schools

Unit # 4: Cell Communication and Cell Cycle

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● IST-3: Cells communicate by generating, transmitting, receiving, and responding to chemical signals.</li> <li>● ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.</li> <li>● IST-1: Heritable information provides for continuity of life.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>● In what ways do cells use energy to communicate with one another?</li> <li>● How does the cell cycle aid in the conservation of genetic information?</li> <li>● Why and in what ways do cells communicate with one another?</li> </ul>
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**Interdisciplinary Connection**

NJSLS ELA W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Students will demonstrate their science writing abilities through a cancer research paper.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
4.1	Cell Communication	1.B Explain biological concepts and/or processes.	One-minute essay, Yeast analogy story, Hormone matching	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Buffalo Case Studies	Google forms quiz
4.2	Signal Transduction	1.A Describe biological concepts and/or processes.  6.C Provide reasoning to justify a claim by connecting evidence to biological theories.	Ask the expert, Group modeling, Act it Out	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Buffalo Case Studies	Case study analysis
4.3	Changes to Signal Transduction	6.E.b Predict the cause/effects of a change in, or disruption to, one or more components in a biological system based on a visual representation of a biological concept, process, or model.	Partner/Group case study analysis	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Buffalo Case Studies, HHMI	Quizizz

4.4	Feedback	6.E.b Predict the cause/effects of a change in, or disruption to, one or more components in a biological system based on a visual representation of a biological concept, process, or model.	Guided notes, Drawing diagrams, Fishbowl	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Bozeman Science	Self-reflection notecard
4.5	Cell Cycle	4.B.b Describe data from a table of graph, including describing trends and/or patterns in the data.  5.A.e Perform mathematical calculations, including percentages.	Graph and Switch, Think/Pair/Share	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Crash Course Online Videos	AP Collegeboard practice quiz
4.6	Regulation of Cell Cycle	6.E.a Predict the cause/effects of a change in, or disruption to, one or more components in a biological system based on a biological concept, process, or model.	CER, Turn and Talk	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, HELA Video	Cancer Paper  Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response

## Robbinsville Public Schools

### Unit # 5: Heredity

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● IST-1: Heritable information provides for continuity of life.</li> <li>● EVO-2: Organisms are linked by lines of descent from common ancestry.</li> <li>● SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>● How is our understanding of evolution influenced by our knowledge of genetics?</li> <li>● Why is it important that not all inherited characteristics get expressed in the next generation?</li> <li>● How would Mendel's laws have been affected if he had studied a different type of plant?</li> <li>● How does the diversity of a species affect inheritance?</li> </ul>
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#### Interdisciplinary Connection

Math: Using Probability to Make Decisions - B. Use probability to evaluate outcomes of decisions. Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Students will use the rules of probability to determine possible results from various genetic crosses. Students will use statistics and chi-square analysis to determine if experimental observed values are statistically significant when compared to expected values.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
5.1	Meiosis and Genetic Diversity	<p>1.B Explain biological concepts and/or processes.</p> <p>3.A Identify or pose a testable question based on an observation, data, or a model.</p>	Think-Pair-Share, Meiosis pop bead modeling	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Mitosis/Meiosis Lab Write-Up
5.2	Mendelian Genetics	<p>5.C Select and perform appropriate statistical hypothesis testing.</p> <p>6.E.c Predict the cause or effects of a change in, or disruption to, one or more components in a biological system based on data.</p>	Corn chi-square, Practice word problems, Free response practice essay	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Self-reflection on free response using rubric
5.3	Non-Mendelian Genetics	<p>5.A.b Perform mathematical calculations, including means.</p> <p>5.C Select and perform appropriate statistical hypothesis testing.</p>	Construct an argument, Virtual fly lab	Campbell Textbook, Powerpoint, Collegeboard Online Classroom, Bozeman	Chi-Square Lab Write-Up

5.4	Environmental Effects on Phenotype	1.C Explain biological concepts, processes, and/or models in applied contexts.	Lecture, Guided notes	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Notecard questions, Misconception check
5.5	Chromosomal Inheritance	6.E.b Predict the cause or effects of a change in, or disruption to, one or more components in a biological system based on visual representations.	Debate, Analyze data sets	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Reflection Survey Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response

Robbinsville Public Schools

Unit # 6: Gene Expression and Regulation

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● IST-1: Heritable information provides for continuity of life.</li> <li>● IST-2: Differences in the expression of genes account for some of the phenotypic differences between organisms.</li> <li>● IST-4: The processing of genetic information is imperfect and is a source of genetic variation.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>● How does gene regulation relate to the continuity of life?</li> <li>● How is a species' genetic information diversified from generation to generation?</li> </ul>
<p><b>Interdisciplinary Connection</b></p>	
<p>NJSLS ELA W.11-12.6 Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. Assess peer feedback and adapt writing according to feedback. Students will provide peer feedback on lab reports and presentations. Classes will take this feedback to make corrections and improvements to their work before submission to be graded.</p> <p>Comprehensive Health and Physical Education: 2.3.12.A.1 Medicines come in a variety of forms (prescription medicines, over-the-counter medicines, medicinal supplements), are used for numerous reasons, and should be taken as directed in order to be safe and effective. Determine the potential risks and benefits of the use of new or experimental medicines and herbal and medicinal supplements. Students will debate ethical concerns, both local and global, in relation to emerging biotechnologies.</p>	

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
6.1	DNA and RNA Structure	1.C Explain biological concepts, processes, and/or models in applied contexts.	Strawberry DNA Extraction Lab, Color coding	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	DNA lab questions analysis
6.2	Replication	2.B.b Explain relationships between different characteristics of biological concepts, processes, or models represented visually in applied contexts.	Building paper models	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Student teaching the teacher using model, Peer teaching, End of class misconception check

6.3	Transcription and RNA Processing	2.B.b Explain relationships between different characteristics of biological concepts, processes, or models represented visually in applied contexts.	Think-Pair-Share, Diagram labeling	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Student teaching the teacher using model, Peer teaching, Self-reflection check
6.4	Translation	2.D.b Represent relationships within biological models, including diagrams.  6.E.a Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on biological concepts.	Construct an Argument, Practice coding worksheets	College Board secure documents	Check for understanding notecard questions
6.5	Regulation of Gene Expression	6.A Make a scientific claim.	Graded free response, Stickleback fish Pitx gene switch videos with analysis worksheets	Collegeboard Classroom, HHMI	Gene Switch Project/Model
6.6	Gene Expression and Cell Specialization	6.B Support a claim with evidence from biological principles, concepts, processes, and/or data.	Lactose Intolerance Lab, Skin Color Case Study	HHMI, Buffalo Case Studies	Analysis questions
6.7	Mutations	2.C Explain how biological concepts or processes represented visually relate to larger biological principles, concepts, processes, or theories.  3.D Make observations or collect data from representations of lab setups or results.	Paper modeling and analysis	Campbell Textbook, Powerpoint, Collegeboard Online Classroom	Paper modeling write-up
6.8	Biotechnology	6.D Explain the relationship between experimental results and larger biological concepts, processes, or theories.	Restriction Digest Lab, Gel Electrophoresis, Transformation	AP Lab Manual	Restriction Digest Lab, Gel Electrophoresis, Transformation Lab Write-Ups  Personal Progress Checks using College

					Board Classroom, Unit Exam - Multiple Choice, Math, Free Response
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## Robbinsville Public Schools

### Unit # 7: Natural Selection

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.</li> <li>● EVO-2: Organisms are linked by lines of descent from common ancestry.</li> <li>● EVO-3: Life continues to evolve within a changing environment.</li> <li>● SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions within the environment.</li> </ul>	<p><b>Essential Questions:</b></p> <ul style="list-style-type: none"> <li>● What conditions in a population make it more or less likely to evolve?</li> <li>● What scientific evidence is available to defend the theory of evolution?</li> <li>● How do species interaction encourage or slow changes in species?</li> </ul>
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#### Interdisciplinary Connection

Math: Quantities - A. Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. Students will use their quantitative math skills to analyze the changes to various populations over time in order to determine if populations are evolving. Students will graph changing populations and explain the various trends/relationships.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
7.1	Introduction to Natural Selection	2.A Describe characteristics of a biological concept, process, or model represented visually.	Free Response Practice Questions, Lecture	AP Campbell Textbook	Review, Group Share, and Reflect on writing responses
7.2	Natural Selection	1.B Explain biological concepts and/or processes.	Guided Notes, Multiple Choice Practice Questions	AP Campbell Textbook	Review and reflect, Share out
7.3	Artificial Selection	4.B.c Describe data from a table or graph, including describing relationships between variables.	Construct an Argument	Whiteboard	Peer critique

7.4	Population Genetics	3.B State the null and alternative hypotheses, or predict the results of an experiment.	Lecture, Word problem practice questions	AP Lab Manual, AP Formula Sheet	Mathematical calculations with explanations
7.5	Hardy Weinberg Equilibrium	5.A.a Perform mathematical calculations, including mathematical equations in the curriculum.  1.C Explain biological concepts, processes, and/or models in applied contexts.	Error Analysis using Teddy Grahams	AP Lab Manual, AP Formula Sheet	Mathematical calculations with explanations
7.6	Evidence of Evolution	4.B.a Describe data from a table or graph, including identifying specific data points.	Stations to analyze various pieces of evidence, concept mapping	Campbell Textbook	Generate AP Review Questions
7.7	Common Ancestry & Phylogeny	6.E.b Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on a visual representation of a biological concept, process, or model.  2.D.c Represent relationships within biological models, including flowcharts.	Speciation cartoon drawings, Turn and talk	Campbell Textbook	Notecard review questions
7.8	Speciation	6.E.a Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on biological concepts.  2.B.b Explain relationships between different characteristics of biological concepts, processes, or models represented visually in theoretical contexts.	Ask an Expert, Jigsaw, Phylogeny diagram drawings	Campbell Textbook	Notecard review questions

7.9	Extinction	3.B State the null and alternative hypotheses, or predict the results of an experiment.	Analyze data sets	Various online sources	Personal Progress Checks using College Board Classroom
7.10	Origin of Life on Earth	3.B State the null and alternative hypotheses, or predict the results of an experiment.	Analyze data sets, Videos with questions, Turn and talk	Projector, Whiteboard	Unit Exam - Multiple Choice, Math, Free Response

## Robbinsville Public Schools

### Unit # 8: Ecology

<p><b>Enduring Understandings:</b></p> <ul style="list-style-type: none"> <li>● ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.</li> <li>● IST-5: Transmission of information results in changes within and between biological systems.</li> <li>● ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.</li> <li>● SYI-1: Living systems are organized in a hierarchy of structural levels that interact.</li> <li>● ENE-4: Communities and ecosystems change on the basis of interactions among populations and disruptions to the environment.</li> <li>● SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.</li> <li>● EVO-1: Evolution is characterized by change in the genetic make-up of a population over time and is supported by multiple lines of evidence.</li> </ul>	<p><b>Essential Questions: :</b></p> <ul style="list-style-type: none"> <li>● How does diversity among and between species in a biological system affect the evolution of species within the system?</li> <li>● How does the acquisition of energy relate to the health of a biological system?</li> <li>● How do communities and ecosystems change, for better or for worse, due to biological disruptions?</li> <li>● How does a disruption of a biological system affect genetic information storage and transmission?</li> <li>● How do species interactions affect the survival of an ecosystem?</li> </ul>
<p><b>Interdisciplinary Connection</b></p>	
<p>NJSLS ELA RL.11.12.1 Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain. Develop claim(s) and counterclaims avoiding common logical fallacies and using sound reasoning and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience’s knowledge level, concerns, values, and possible biases. Provide a concluding paragraph or section that supports the argument presented (e.g., articulating implications or the significance of the topic).</p>	
<p>NJSLS ELA SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on various topics, texts, and issues, building on others’ ideas and expressing their own clearly and persuasively. Students will investigate and debate the pros/cons of emerging environmental technologies. Students will discuss the impact of human activity on local, regional, and global communities.</p>	

<b>Guiding / Topical Questions with Specific Standards</b>	<b>Content, Themes, Concepts, and Skills</b>	<b>Teaching Strategies</b>	<b>Instructional Resources and</b>	<b>Assessment Strategies</b>
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				<b>Materials</b>	
8.1	Response to Environment	3.C.a Identify experimental procedures that are aligned to the question, including identifying variables.	Error Analysis, Analyzing data sets	Campbell Textbook	Group misconception check
8.2	Energy Flow Through Ecosystems	6.D Explain the relationship between experimental results and larger biological concepts, processes, or theories.	Virtual Lab Simulation	HHMI	Extension questions and analysis
8.3	Population Ecology & Effect of Density on Populations	4.A Construct a graph, plot, or chart. 5.A.c Perform mathematical calculations, including rates.	Word problem practice questions	AP Campbell textbook	Student presentations at the whiteboard
8.4	Community Ecology	5.B Use confidence intervals and/or error bars to determine whether sample means are statistically different.	Graph and Switch	AP Campbell textbook	Google form quiz
8.5	Biodiversity	6.E.c Predict the causes or effects of a change in, or disruption to, one or more components in a biological system based on data.	Analyze data sets	AP Campbell textbook	Quizizz, Notecard review
8.6	Disruptions to Ecosystems	5.D.a Use data to evaluate a hypothesis (or prediction) including rejecting or failing to reject the null hypothesis.	Index Card Summaries/Questions	Current events articles, AP Campbell textbook	Personal Progress Checks using College Board Classroom, Unit Exam - Multiple Choice, Math, Free Response

## General Differentiated Instruction Strategies

<ul style="list-style-type: none"> <li>● Leveled texts</li> <li>● Chunking texts</li> <li>● Choice board</li> <li>● Socratic Seminar</li> <li>● Tiered Instruction</li> <li>● Small group instruction</li> <li>● Guided Reading</li> <li>● Sentence starters/frames</li> <li>● Writing scaffolds</li> <li>● Tangible items/pictures</li> <li>● Adjust length of assignment</li> </ul>	<ul style="list-style-type: none"> <li>● Repeat, reword directions</li> <li>● Brain breaks and movement breaks</li> <li>● Brief and concrete directions</li> <li>● Checklists for tasks</li> <li>● Graphic organizers</li> <li>● Assistive technology (spell check, voice to type)</li> <li>● Study guides</li> <li>● Tiered learning stations</li> <li>● Tiered questioning</li> <li>● Data-driven student partnerships</li> <li>● Extra time</li> </ul>
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### Possible Additional Strategies for Special Education Students, 504 Students, At-Risk Students, and English Language Learners (ELLs)

Time/General	Processing	Comprehension	Recall
<ul style="list-style-type: none"> <li>● Extra time for assigned tasks</li> <li>● Adjust length of assignment</li> <li>● Timeline with due dates for reports and projects</li> <li>● Communication system between home and school</li> <li>● Provide lecture notes/outline</li> </ul>	<ul style="list-style-type: none"> <li>● Extra Response time</li> <li>● Have students verbalize steps</li> <li>● Repeat, clarify or reword directions</li> <li>● Mini-breaks between tasks</li> <li>● Provide a warning for transitions</li> <li>● Reading partners</li> </ul>	<ul style="list-style-type: none"> <li>● Precise step-by-step directions</li> <li>● Short manageable tasks</li> <li>● Brief and concrete directions</li> <li>● Provide immediate feedback</li> <li>● Small group instruction</li> <li>● Emphasize multi-sensory learning</li> </ul>	<ul style="list-style-type: none"> <li>● Teacher-made checklist</li> <li>● Use visual graphic organizers</li> <li>● Reference resources to promote independence</li> <li>● Visual and verbal reminders</li> <li>● Graphic organizers</li> </ul>
Assistive Technology	Assessments and Grading	Behavior/Attention	Organization
<ul style="list-style-type: none"> <li>● Computer/whiteboard</li> </ul>	<ul style="list-style-type: none"> <li>● Extended time</li> </ul>	<ul style="list-style-type: none"> <li>● Consistent daily structured</li> </ul>	<ul style="list-style-type: none"> <li>● Individual daily planner</li> </ul>

<ul style="list-style-type: none"> <li>● Tape recorder</li> <li>● Spell-checker</li> <li>● Audio-taped books</li> </ul>	<ul style="list-style-type: none"> <li>● Study guides</li> <li>● Shortened tests</li> <li>● Read directions aloud</li> </ul>	<ul style="list-style-type: none"> <li>● routine</li> <li>● Simple and clear classroom rules</li> <li>● Frequent feedback</li> </ul>	<ul style="list-style-type: none"> <li>● Display a written agenda</li> <li>● Note-taking assistance</li> <li>● Color code materials</li> </ul>
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## 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](http://www.Duolingo.com)
- Time on task for students-<http://www.online-stopwatch.com/>
- Differentiation activities for students based on their Lexile-[www.Mobymax.com](http://www.Mobymax.com)
- WIDA-<http://www.wida.us/>
- Everything ESL - <http://www.everythingESL.net>
- ELL Tool Box Suggestion Site [Http://www.wallwisher.com/wall/ell toolbox](http://www.wallwisher.com/wall/ell%20toolbox)
- 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 embedded 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>
- Paccar -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/>