

**MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY**

**Moorestown High School
Science Department**

**AP Biology
Grades 11-12**

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[Course Description and Fundamental Concepts](#)

AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes, energy and communication, genetics, information transfer, ecology, and interactions.

The AP Biology course is equivalent to a two-semester college introductory biology course for biology majors.

The Advanced Placement Curriculum is scaffold around the 4 big ideas.

Big Idea 1: The process of evolution drives the diversity and unity of life

Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis

Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes

Big Idea 4: Biological systems interact, and these systems and their interactions possess Complex properties

The college board offers AP Classroom, which is a website organized into eight units (Units 1-8 of curriculum) that offers review videos and practice multiple choice and free response questions. The units are organized to utilize the AP Classroom resources.

The Investigative Laboratory Component:

The laboratory component of the course will include a minimum of 25% of the content. As per the AP requirement, a minimum of 2 of the student-directed laboratory investigations will be conducted for each big idea. Because conceptual understanding is fostered by inquiry the goal throughout the course will be to engage the students in more than the required 8 laboratory exercises. Additional laboratory exercises have been included within the syllabus as time permits.

Science Practices:

Science practices have been keyed to the laboratory exercises for each unit. The list includes the major practices emphasized.

1. The student can use representations and models to communicate scientific phenomena and solve scientific problems
2. The student and use mathematics appropriately
3. The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
4. The student can plan and implement data collection strategies appropriate to a particular scientific question
5. The student can perform data analysis and evaluation of evidence.
6. The student can work with scientific explanations and theories
7. The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains

[New Jersey Student Learning Standards \(NJSLS\)](#)

Subject/Content Standards

Include grade appropriate subject/content standards that will be addressed

Standard #	Standard Description
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment .
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-4	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6	Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS2-3	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
HS-LS2-2	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-LS2-8	Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

English Companion Standards

List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 6-12. English Companion Standards are required in these subject/content areas.

Unit Addressed	Standard #	Standard Description
7	RST.9-10.8	Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8)
0-8	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 in the account. (HS-LS1-1),(HS-LS1-6)

7	RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6), (HS-LS2-7), (HS-LS2-8)
7	RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS4-5)
3,4,5,7	WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1-1),(HS-LS1-6)
3	WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)
8,9	WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HSL1-3)
7,6,8,9	WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS-1-1),(HS-LS1-6)
7	SL.11-12.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-LS4-1), (HS-LS4-2)
3	SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2), (HS-LS1-4), (HS-LS1-5), (HS-LS1-7)

Career Awareness, Exploration, Preparation, and Training ([Standard 9.2](#))

List appropriate units below for which standards will be addressed

By Grade 12

Unit Addressed	Core Idea	Standard / Description
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0-9	There are strategies to improve one’s professional value and marketability.	<p>9.2.12.CAP.1: Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.</p> <p>9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.</p> <p>9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.</p>
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.	<p>9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.</p> <p>9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.</p> <p>9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.</p> <p>9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.</p> <p>9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.</p> <p>9.2.12.CAP.9: Locate information on working papers, what is required to obtain them, and who must sign them.</p> <p>9.2.12.CAP.10: Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).</p> <p>9.2.12.CAP.11: Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education.</p>
	An individual’s income and benefit needs and financial plan can change over time.	<p>9.2.12.CAP.12: Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.</p>

		<i>9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.</i>
	Securing an income involves an understanding of the costs and time in preparing for a career field, interview and negotiation skills, job searches, resume development, prior experience, and vesting and retirement plans.	<i>9.2.12.CAP.14: Analyze and critique various sources of income and available resources (e.g., financial assets, property, and transfer payments) and how they may substitute for earned income.</i>
	Understanding income involves an analysis of payroll taxes, deductions and earned benefits.	<p><i>9.2.12.CAP.15: Demonstrate how exemptions, deductions, and deferred income (e.g., retirement or medical) can reduce taxable income.</i></p> <p><i>9.2.12.CAP.16: Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g., property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments.</i></p> <p><i>9.2.12.CAP.17: Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice.</i></p> <p><i>9.2.12.CAP.18: Differentiate between taxable and nontaxable income from various forms of employment (e.g., cash business, tips, tax filing and withholding).</i></p> <p><i>9.2.12.CAP.19: Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income.</i></p> <p><i>9.2.12.CAP.20: Analyze a Federal and State Income Tax Return.</i></p>
	There are ways to assess a business's feasibility and risk and to align it with an individual's financial goals.	<p><i>9.2.12.CAP.21: Explain low-cost and low-risk ways to start a business.</i></p> <p><i>9.2.12.CAP.22: Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.</i></p> <p><i>9.2.12.CAP.23: Identify different ways to obtain capital for starting a business</i></p>

Life Literacies and Key Skills ([Standard 9.4](#))*List appropriate units below for which standards will be addressed*

By Grade 12		
Unit Addressed	Core Idea	Standard / Description
2	Creativity and Innovation: With a growth mindset, failure is an important part of success.	9.4.12.CI.1: <i>Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).</i>
2	Creativity and Innovation: Innovative ideas or innovation can lead to career opportunities.	9.4.12.CI.2: <i>Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).</i> 9.4.12.CI.3: <i>Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).</i>
9	Critical Thinking and Problem-solving: Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	9.4.12.CT.1: <i>Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).</i> 9.4.12.CT.2: <i>Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).</i> 9.4.12.CT.3: <i>Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice).</i> 9.4.12.CT.4: <i>Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.</i>
	Digital Citizenship: Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	9.4.12.DC.1: <i>Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a).</i> 9.4.12.DC.2: <i>Compare and contrast international differences in copyright laws and ethics</i>

	<p>Digital Citizenship: Laws govern many aspects of computing, such as privacy, data, property, information, and identity. These laws can have beneficial and harmful effects, such as expediting or delaying advancements in computing and protecting or infringing upon people’s rights.</p>	<p><i>9.4.12.DC.3: Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).</i></p> <p><i>9.4.12.DC.4: Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).</i></p> <p><i>9.4.12.DC.5: Debate laws and regulations that impact the development and use of software.</i></p>
	<p>Digital Citizenship: Cultivating online reputations for employers and academia requires separating private and professional digital identities.</p>	<p><i>9.4.12.DC.6: Select information to post online that positively impacts personal image and future college and career opportunities.</i></p>
0	<p>Digital Citizenship: Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.</p>	<p><i>9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).</i></p>
	<p>Digital Citizenship: Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.</p>	<p><i>9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.</i></p>
	<p>Global and Cultural Awareness: Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.</p>	<p><i>9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).</i></p>

	<p>Information and Media Literacy: Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.</p>	<p><i>9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information.</i></p> <p><i>9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources).</i></p>
0-9	<p>Information and Media Literacy: Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully</p>	<p><i>9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)</i></p> <p><i>9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).</i></p>
	<p>Information and Media Literacy: In order for members of our society to participate productively, information needs to be shared accurately and ethically.</p>	<p><i>9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2).</i></p> <p><i>9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).</i></p>
	<p>Information and Media Literacy: Accurate information may help in making valuable and ethical choices.</p>	<p><i>9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).</i></p>
0-9	<p>Information and Media Literacy: Media have embedded values and points of view.</p>	<p><i>9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6).</i></p> <p><i>9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4).</i></p>

0-9	Technology Literacy: Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task.	9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specific task (e.g., W.11-12.6). 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
	Technology Literacy: Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.	9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments. 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).

Interdisciplinary Connections ([2020 NJSLs](#))

List any other content standards addressed as well as appropriate units. All arts integration connections may be listed within this chart.

Visual & Performing Arts Integration ([Standard 1](#)) List appropriate units below for which standards (1.1 through 1.5) may be addressed

Unit Addressed	Artistic Process	Anchor Standard
1,2,8	Creating	<i>Anchor Standard 1: Generating and conceptualizing ideas. Anchor Standard 2: Organizing and developing ideas. Anchor Standard 3: Refining and completing products.</i>
0,5	Connecting	<i>Anchor Standard 10: Synthesizing and relating knowledge and personal experiences to create products. Anchor Standard 11: Relating artistic ideas and works within societal, cultural, and historical contexts to deepen understanding.</i>
6	Performing/ Presenting/ Producing	<i>Anchor Standard 4: Selecting, analyzing, and interpreting work. Anchor Standard 5: Developing and refining techniques and models or steps needed to create products. Anchor Standard 6: Conveying meaning through art.</i>
	Responding	<i>Anchor Standard 7: Perceiving and analyzing products. Anchor Standard 8: Applying criteria to evaluate products. Anchor Standard 9: Interpreting intent and meaning.</i>

Other Interdisciplinary Content Standards

List appropriate units below for any other content/standards that may be addressed

Unit Addressed	Content / Standard #	Standard Description
7	Math / MP.2	Reason abstractly and quantitatively. (HS-LS4-1), (HS-LS4-2), (HS-LS4-3), (HS-LS4-4), (HS-LS4-5)
7	Math / MP.4	Model with mathematics. (HS-LS4-2)
0,1,2,8,9	Math / HSF-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. (HS-LS1-4)
2, 8, 9	Math / HSF-BF.A.1	Write a function that describes a relationship between two quantities. (HS-LS1-4)
2,9	Math / HSN-Q.A.1	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. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
0,9	Math / HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)
0	Math / HSS-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (HS-LS2-6)
0, 8, 9	Math / HSS-IC.B.6	Evaluate reports based on data. (HS-LS2-6)

[Pacing Guide](#)

Pacing GuideUnit/ Topic	Month (w/Approx number of Teaching Days)
Unit 0 - Statistics, experimental design, and CER (HS-LS3-3)	September (~5 days)
Unit 1 - Chemistry of Life (HS- LS1-6, LS1-1)	September (~12 days)
Unit 2 - Cell Structure and Function (HS-LS1-2, HS-LS1-3)	October (~14 days)
Unit 3 - Cellular Energetics (HS-LS1-5, HS-LS1-7, HS-LS2-3)	November (~17 days)
Unit 4 - Cell Communication and Cell Cycle (HS-LS1-2, HS-LS1-3, HS-LS1-4)	December (~15 days)
Unit 5 - Heredity (HS-LS3-1, HS-LS3-2, HS-LS3-3) Review of semester topics -Midterm exam	January (~18 days)
Unit 6: Gene Expression and Regulation (HS-LS1-1, (HS-LS1-4, HS-LS3-2)	February (~19 days)
Unit 7 - Natural Selection (HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS2-8)	March (~20 days)
Unit 8 - Ecology (HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS2-8, HS-LS4-6)	April (~15 days)
AP Exam Review and Final Exam Unit 9 - Fetal Pig Dissection (HS-LS1-2)	May (~18 days)
Unit 9 - Independent Project (Science and Engineering Practice 3 - Planning and Carrying out an Investigation) The range of topics may be anything throughout the year.	June (~15 days)

UNITS SCOPE AND SEQUENCE

Unit 0: Statistics, Experimental Design, and CER

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSL](#) -

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

NJSL - Technology Integration Standards

NJSL - College and Career Ready Practices

NJSL - Interdisciplinary Standards

Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **Can a graph tell a story?**

Objectives

Students will be able to...

- Define Chi Square, standard deviation, standard error of the mean, positive control, negative control, independent variable, dependent variable, null hypothesis.
- Construct four types of graphs - line, bar, box and whisker, scatter plot.
- Use Claim-Evidence-Reasoning to relate experimental data to scientific concepts.
- Design an experiment to answer a question

Unit 1: Chemistry of Life

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

NJSLs - Technology Integration Standards

NJSLs - College and Career Ready Practices

NJSLs - Interdisciplinary Standards

Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **Unit Big Idea - Why are there different categories on food labels and why do they matter?**

Objectives

Students will be able to...

- Identify four classes of macromolecules using paper models
- Relate Hydrogen bonding of water molecules to properties of water important for life using hands on activities with water, ethanol, and drops on a penny
- Practice claim, evidence, reasoning using graphs and data from water activities
- Model how Interactions between amino acids regulate the shape of a protein using kinesthetic activity

Unit 2: Cell Structure and Function

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

NJSLs - Technology Integration Standards

NJSLs - College and Career Ready Practices

NJSLs - Interdisciplinary Standards

Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **How do organelles help our cells function? Where did they come from?**

Objectives

Students will be able to...

- Students choose shape of agar cube to maximize diffusion
- Determine molarity of unknown sucrose solution using experimental data
- Determine the solute potential of different vegetables.
- Make Organelle profile for Speed Dating to learn organelle function
- Calculate water and solute potential
- Draw transport proteins in membranes using passive and active transport

Unit 3: Cellular Energy

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

How do our cells talk to each other?

How do plants store light energy from the sun? How do animals get energy from the food that they eat? Do each of us have recycled molecules from Einstein? How do humans start chemical reactions without a hot plate?

Objectives

Students will be able to...

- Identify locations of electron transport chains and biochemical cycles in mitochondria
- Identify locations of electron transport chains, photosystems, and biochemical cycles in chloroplasts
- Identify active site and allosteric site on models of enzymes
- Use graph to identify endergonic and exergonic chemical reactions

Unit 4: Cell Communication and Cell Cycle

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **How do our cells talk to each other?**
- **How do our cells know when to divide?**
- **What goes wrong in cancer?**

Objectives

Students will be able to...

- Define paracrine, autocrine, and hormone signals.
- Identify four types of receptors for signal transduction and the four steps of signal transduction pathway.
- Define positive and negative feedback loops.
- Model feedback and homeostasis using hormones in insulin signaling as detailed examples.
- Model Cell Signaling with origami cutouts
- Block taste receptor and experience effect
- Identify diseases of signaling in case study
- Interpret a cell signaling diagram from original research article
- Model Mitosis with pop beads/ pipe cleaners
- Complete POGIL for Cell cycle

Unit 5: Heredity

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **How does a black lab and a yellow lab have chocolate colored puppies?**

Objectives

Students will be able to...

- Count crossing over in Sordaria model and examine crossing over in Sordaria
- Complete Punnett Squares following Mendelian and non-Mendelian genetics
- Count Drosophila crosses in computer modeling
- Calculate map distance in linked genes using drosophila-simulated data
- Relate Chromosome mutation in bone marrow stem cell to translocation and kinase activity

Unit 6: Gene Expression & Regulation

Step 1 – Desired Results: What do I want my students to learn?

Standards

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **Is all DNA the same in all of your cells?**
- **How does DNA determine if you are lactose intolerant?**
- **What is molecular biology?**
- **What is CRISPR- Cas9? Why should we care?**

Objectives

Students will be able to...

- Define enzymes used in DNA replication
- Relate cellular structures to the production of proteins
- Define the function of 3 types of RNA in gene expression
- Predict amino acids in a protein based on DNA sequence
- Model operons in bacteria
- Complete PCR and agarose gel analysis to compare genotype and phenotype
- Transform bacteria to show gene expression of fluorescent protein in bacteria

Unit 7: Natural Selection

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence

HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment .

HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **How do animals look different from each other and match their environment?**
- **How do new species evolve?**

Objectives

Students will be able to...

- Describe Four steps of natural selection
- Define the five categories of evidence of evolution
- Draw graphs to represent modes of evolution
- Define species, population, adaptation, fitness, common ancestor
- Sort species cards/shells to show speciation
- Calculate variables of Hardy Weinberg equilibrium
- Draw a cladogram
- Interpret a phylogenetic tree
- Model microevolution in a simulation
- Model bottleneck and founder effect in a simulation

Unit 8: Ecology

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLS](#) -

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- **Unit Big Idea- Do bees really communicate with each other to find nectar?**
- **Why do so many mosquitoes hatch at once?**
- **Do all organisms have equal effects on their ecosystem?**
- **Are humans harming the earth? Are humans causing species to go extinct?**

Objectives

Students will be able to...

- Classify Animal Behavior into response/stimulus.
- Measure animal behavior responses in lab activity or virtual bee dance
- Relate energy flow to food chains, food webs and endotherms vs ectotherms.
- Identify types of organisms with R and K survival strategies
- Calculate changes in population growth.
- Interpret graphs that show changes in population size over time.
- Define exponential growth and logistical growth.
- Identify density dependent (biotic) and independent (abiotic) factors.
- Define types of symbiotic relationships.
- Calculate diversity of species on an island in an online simulation with Simpson's Diversity Index.
- Identify advantages of biodiversity and relate to keystone species.

- Identify disruptions to an ecosystem including invasive species, human impacts, and natural occurrences.

Unit 9: Fetal Pig Dissection and Independent Project

Step 1 – Desired Results: What do I want my students to learn?

Standards

[NJSLs](#) -

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

*HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.**

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Unit Big Ideas:

(What Fundamental Concepts Should be Learned during this Unit?)

- Relationship between form and function.
- How to design an experiment based on prior results.

Objectives

Students will be able to...

- Dissect a fetal pig
- Design, conduct, and interpret results of an original experiment

Please contact the Content Supervisor for any questions.