**High School**

**AP Biology**

**Curriculum Guide**

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**LINDEN PUBLIC SCHOOLS**

**LINDEN, NEW JERSEY**

**Dr. Marnie Hazelton**

**Superintendent**

**Denise Cleary**

**Assistant Superintendent**

**Michael Walters**

**Director of Science**

**The Linden Board of Education adopted the Curriculum Guide on:**

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| **July 28, 2022** |  | **Education Report #26** |
| **Date** |  | **Agenda Item** |
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| **Rationale****Be it resolved, that all curricula within the following content areas be readopted for use in the Linden Public Schools for the 2022-2023 school year. All curricula are aligned to the** **New Jersey Student Learning Standards.**  |

**Public Notice of Non-Discrimination**

If any student or staff member feels that they have experienced discrimination on the basis of race, color, creed, religion, gender, ancestry, national origin, social or economic status, sexual orientation or disability, contact:

Affirmative Action Officer

Kevin Thurston – (908) 486-5432 ext. 8307; kthurston@lindenps.org

504 Officer & District Anti-Bullying Coordinator

Annabell Louis – (908) 486-2800 ext. 8025; alouis@lindenps.org

Title IX Coordinator

Steven Viana – (908) 486-7085; sviana@lindenps.org

Director of Special Education

Marie Stefanick – (908) 587-3285; mstefanick@lindenps.org

**Linden Public Schools Vision**

The Linden Public School District is committed to developing respect for diversity, excellence in education, and a commitment to service, in order to promote global citizenship and ensure personal success for all students.

**Linden Public Schools Mission**

The mission of the Linden Public School District is to promote distinction through the infinite resource that is Linden’s diversity, combined with our profound commitment to instructional excellence, so that each and every student achieves their maximum potential in an engaging, inspiring, and challenging learning environment.

**Science Department Vision**

Our vision is to develop scientifically literate students, by teaching them to think critically, become problem-solvers, and develop into life-long learners. Our classrooms will be collaborative settings that are driven by discovery, exploratory learning, and which require each student to actively engage throughout the learning to successfully construct explanations and design solutions.

**Science Department Mission Statement**

The mission of the Science Department is to create a community of diverse learners and educators who foster equitable active learning, quantitative reasoning, and scientific inquiry. Through integration of classroom laboratory, research, and practical experiences, students acquire skills necessary for life-long learning, critical thinking, and collaborative problem-solving. Our students will engage in the “Practices of Science” as they investigate the natural and designed worlds seeking to construct explanations for phenomena and design solutions for problems. They will collaboratively ask questions, develop and use models, plan and carry out investigations, analyze data, use mathematics and computational thinking, construct explanations, engage in argument from evidence, and obtain, evaluate, and communicate information. These will serve as foundations for informed, responsible citizens, and their successful careers, in an ever-changing world that is increasingly dependent on evidence-based decision making, science, technology, and engineering.

**Science Department Goals**

The Science Department strives to provide ***all*** students with an engaging program that:

• Captures the imagination and curiosity, producing scientifically literate, life-long learners.

• Develops critical thinking skills, positive science attitudes, and problem-solving skills through collaborative, inquiry centered investigation.

• Provides context and connections to deepen their proficiency in literacy, mathematics, and use of technology; and

 • Continuously improves through professional learning experiences which ensure equity and excellence in on-going, research-based educator development.

Recommended Science Course Progression

It is highly recommended that students have taken at least one chemistry course and one biology course (with at least one of them being honors level) before enrolling in the advanced placement biology course

Gifted and Talent Accommodations and Modifications:

-Formative assessment in personal progress checks will be used allowing students achieving at a high level to deepen their skills and to prep for AP end-of-year test for biology

-Students will be encouraged to delve into topics they find interest in by doing further research and finding how different topics relate to their planned future course of study/career

-Flexible and strategic work groups to challenge students and to grow as a learner

Special Education, and At-Risk Accommodations and Modifications:

-Extended time on tests as needed

-Outline notes and graphic organizers will be made and offered to students on an as needed basis

-Key vocabulary, multiple meaning words, and figurative language will be thoroughly defined

-Meetings and review of course material with/between small cooperative learning groups

English Language Learners:

-Lesson on prefixes and suffixes towards the beginning of the year, central aspects to this lesson as well as a guide sheet will be available to students throughout the year

**New Jersey Department of Education - State Instructional Mandates:**

* The course itself is an elective science course, not required of all students to fulfill graduation requirements, however the course will fulfill the requirements for advanced placement certification and allow students to sit for the AP Biology end-of-year exam.
1. **6 science Practice skills required in AP courses (As per AP Biology Course Exam and Description)**
* Concept explanation-explain biological concepts, processes, and models presented in written format SP1
1. Describe biological concepts or processes
2. Explain biological concepts or processes
3. Explain biological concepts, processes, or models in applied contexts
* Visual representation-analyze visual representations of biological concepts and processes SP2
1. Describe characteristics of a biological concept, process, or model represented visually
2. Explain relationships between different characteristics of biological concepts, processes, or models represented visually
3. Explain how biological concepts or processes represented visually relate to larger biological principles, concepts, processes, or theories
4. Represent relationships within biological models, including mathematical models, diagrams, and flow charts
* Questions and methods-determine scientific questions and methods SP3
1. Identify or pose a testable question based on an observation, data, or a model
2. State the null or alternative hypotheses, or predict the results of an experiment
3. Identifying experimental procedures are aligned to the question
4. Make observations, or collect data from representations of laboratory setups or results
* Representing and describing data-represent and describe data SP4
1. Construct a graph, plot, or chart
2. Describe a data from a table or graph including identifying specific data points, describing trends or patterns in data, describing relationships between variables
* Statistical tests and data analysis-perform statistical tests and mathematical calculations to analyze and interpret data SP5
1. Perform mathematical calculations
2. Use confidence intervals or error bars to determine whether a sample means are statistically different
3. Perform a chi-square hypothesis test
4. Use data to evaluate a hypothesis
* Argumentation-develop and justify scientific arguments using evidence SP6
1. Make a scientific claim
2. Support a claim with evidence from biological principles, concepts, processes, and/or data
3. Provide reasoning to justify a claim by connecting evidence to biological theories
4. Explain the relationship between experimental results and larger biological concepts, processes, or theories
5. Predict the causes or effect of a change in, disruption to, one or more components in a biological system
6. **Primary & Secondary Source Analysis:**

The primary source for the course will be **Biology for the AP course** by James Morris. The book is newly published and considered the ideas and experiences of teachers, college professors, and researchers that have all been in their profession for several decades. It has been designed to match pace and order of the standard AP curriculum given in the College Board Course and Exam Description (CED) guide module-by-module. In addition, each module features two to four learning goals that align with common national standards in education (Morris, 2022). Concept checks are assigned as a brief summative assessment to correspond with each module to allow students to check their understanding of crucial concepts, and to prepare for the AP exam in Biology.

1. **Standards Guiding Instruction**

New Jersey Student Learning Standards for Science

<https://www.nj.gov/education/standards/science/Index.shtml>

New Jersey Student Learning Standards for English Language Arts

<https://www.nj.gov/education/standards/ela/Index.shtml>

New Jersey Student Learning Standards for Mathematics

<https://www.nj.gov/education/standards/math/Index.shtml>

New Jersey Student Learning Standards for Social Studies

<https://www.nj.gov/education/standards/socst/index.shtml>

New Jersey Student Learning Standards for Computer Science and Design Thinking

<https://www.nj.gov/education/standards/compsci/Index.shtml>

New Jersey Student Learning Standards for Career Readiness, Life Literacies & Key Skills

<https://www.nj.gov/education/standards/clicks/index.shtml>

1. **Pacing Guide**

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| 9/6/22-11/15/22 | FirstMarking Period | Unit I: Chemistry of LifeUnit II: Cell Structure and FunctionUnit III: Cellular Energetics |
| 11/16/22-1/31/23 | SecondMarking Period | Unit IV: Cellular Energetics Unit V: Heredity |
| 2/1/23-4/5/23 | ThirdMarking Period | Unit VI: Gene Expression and RegulationUnit VII: Natural Selection and Adaptations |
| 4/17/23-6/22/23 | FourthMarking Period | Unit VIII: EcologyAdvanced Placement Biology Test PrepCareers in Biology/Future Developments Within the Field |

1. **New Jersey Science Course Curriculum Objectives**

Though the course is not required to follow state objectives, these in addition to AP requirements are used as a guideline to form the course.

**HS. Structure and Function**

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| **HS. Structure and Function**  |
| **Students who demonstrate understanding can:** **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.** [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.] **LHS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.] **HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.] page16image3596809344page16image3596809632page16image3596809920page16image3596810208page16image3596810624page16image3596810912 |
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**HS. Matter and Energy in Organisms and Ecosystems**

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| **HS.Matter and Energy in Organisms and Ecosystems**  |
| Students who demonstrate understanding can: **HS-LS1-5 use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.** [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.] **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.** [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]**HS-LS2-7 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.** [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]**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.** [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]**HS-LS2-4 use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.] **H2-LS2-5 develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.] page17image3596340112 |
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**HS. Interdependent Relationships in Ecosystems**

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| **HS.Interdependent Relationships in Ecosystems**  |
| Students who demonstrate understanding can: **HS-LS2-1 use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.] **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.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]**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.** [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]**HS-LS2-7 design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.\*** [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.] **Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce.** [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]**HS-LS4-6 create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.\*** [Clarification Statement: Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]  |

**HS. Inheritance and Variation of Traits**

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| **HS.Inheritance and Variation of Traits**  |
| Students who demonstrate understanding can: **HS-LS1-4 use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.] **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.** [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]**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.** [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.] **HS-LS3-3 apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.** [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]  |