2018-19 Bibb County Science Pacing Guide for Biology Parts A and B*

Georgia Standards of Excellence: Biology *Always use along with the Georgia Standards of Excellence for Science

Biology: Curriculum Map including the Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas

Science and Engineering Practices	**Crosscutting Concepts**
1. Asking questions and defining problems 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations and designing solutions 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	1. Patterns 2. Cause and effect: Mechanism and explanation 3. Scale, proportion, and quantity 4. Systems and system models 5. Energy and matter: Flows, cycles, and conservation 6. Structure and function 7. Stability and change

Unit/ Timeline	**Standard**	**Curriculum Resources**
Unit 0: Environmental and Life Science Review and Overview **13 days** **Aug 1 – Aug 17**	**SB1**. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. **SB5**. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB1-5, LT 0.1-0.6, PPT Slides 1-36, Quiz 1** ***Theme: Organization of Life*** 1.3 Living vs Nonliving (pg. 17-25) 3.1-What is Ecology (pg. 64-68) 7.1 Cell Structure and Function (pg. 190-195) 11.1 Genetics (pg. 308-312, 314-315)** ***include genotype, phenotype, homozygous and heterozygous.* 18.1- Finding Order in Diversity (pg. 510-515) 18.3 Six Kingdoms Overview (pg. 523-528)

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<tr><td>Learning Targets</td></tr>
<tr><td>K=Knowledge, R=Reasoning, S=Skill, P=Product</td></tr>
<tr><td>• K 0.1—I can identify, explain, and defend the differences between living and non-living things</td></tr>
<tr><td>• K 0.2 – I can define ecology and explain the relationships between living and non-living things.</td></tr>
<tr><td>• K 0.3 – I can list and define the levels of biological organization.</td></tr>
<tr><td>• K 0.4 – I can define and distinguish between the different types of cells.</td></tr>
<tr><td>• K 0.5 – I can explain basic inheritance.</td></tr>
<tr><td>• K 0.6 – I can explain how biodiversity of organisms creates a need for classification systems.</td></tr>
<tr><td>• K 0.7 – I can explain how physical an biological forces have shaped life on Earth</td></tr>
<tr><td>• K 0.8 – I can explain how humans impact life on Earth.</td></tr>
<tr><td>• K 0.9 – I can explain how biodiversity indicates Earth’s health.</td></tr>
<tr><td>• K 0.10 – I can define a population and explain how populations affect one another.</td></tr>
<tr><td>• K 0.11 – I can explain how living and non-living factors affect population growth.</td></tr>
<tr><td>• K 0.12 – I can explain how living things are organized and living and non-living things are interconnected.</td></tr>
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<td>SB5, LT 0.7-0.12 PPT, Slides 37-51, Quiz 2
Theme: Interconnectedness of Life
19.1 Life on a Changing Planet (pg. 544-545)
6.1 A Changing Landscape (pg. 154-157)
6.3-Biodiversity (pg. 166-172)
5.1-How Populations Grow (pg. 130-135)
5.2-Limits to Population Growth (pg. 137-141)</td>
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<td>Unit 1: Stability and Change of Populations over Time

24 days
Aug 20 – Sep 21</td>
<td>SB6. Obtain, evaluate, and communicate information to assess the theory of evolution.
a. Construct an explanation of how new understandings of Earth’s history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology
c. Construct an argument using valid and reliable sources to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence)</td>
<td>Curriculum Documents including learning targets, power points, labs, assessments, etc.

SB6a, LT 1.1 and 1.2, Slides 1-22, Quiz 1
16.1-Darwin’s Voyage of Discovery (pg. 450-458)
16.2- Ideas that Shaped Darwin’s Thinking (pg. 454-459)
16.3-Darwin Presents his Case (pg. 460-464)
SB6c, LT 1.3 and 1.4, Slides 23-40, Quiz 2
19.1-The Fossil Record (pg. 538-545)</td>
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	and genetics support the theory that all living organisms are related by way of common descent. d. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms. (Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.) e. Develop a model to explain the role natural selection plays in causing biological resistance (e.g., pesticides, antibiotic resistance, and influenza vaccines). **SB5**. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. a. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.) e. Construct explanations that predict an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire). **SB4.** Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. c. Construct an argument supported by empirical evidence to compare and contrast the characteristics of viruses and organisms.	16.4-Evidence of Evolution (pg. 465-473) **SB5a, SB5e, SB6d, LT 1.5-1.9, Slides 41-64, Quiz 3** 6.3-Biodiversity (pg. 166-172) 17.2-Evolution as Genetic Change in Populations (pg. 487-492) 17.3-The Process of Speciation (pg. 494-497) **SB4c, SB6e, LT 1.10-1.15, Slides 65-87, Quiz 4** 20.1-Viruses (pg. 574-579) 20.3-Diseases Caused by Bacteria and Viruses (pg. 588-593) **Review and Assessment**

Learning Targets
K=Knowledge, R=Reasoning, S=Skill, P=Product
• **K** 1.1 -- I can describe how the theory of evolution has emerged over time through the work of many scientists
• **K** 1.2 -- I can identify and explain Charles Darwin's ideas on how new species form.
• **K** 1.3 -- I can identify and explain the lines of evidence which are used to support the theory of evolution by common descent: comparative morphology, embryology, biochemistry, and genetics.
• **P** 1.4 -- I can construct an argument using evidence from comparative morphology, embryology, biochemistry, and genetics to support the claim that all living organisms are related by way of common descent.
• **K** 1.5 -- I can define biodiversity and speciation.
• **R** 1.6 -- I can analyze and interpret data to explain patterns in biodiversity that result from speciation via reproductive isolation.
• **K** 1.7 -- I can recognize that undirected genetic changes have led to changes in populations of organisms.
• **K** 1.8 -- I can identify mathematical models that can be used to support explanations of how undirected genetic changes have led to changes in populations of organisms.
• **R** 1.9 -- I can develop and use mathematical models to support explanations of how undirected genetic changes have led to changes in populations of organisms.
• **K** 1.10 -- I can explain the role of natural selection in causing biological resistance.
• **R** 1.11 -- I can develop and analyze models to explain the role of natural selection in causing biological resistance.
• **K** 1.12 -- I can describe the characteristics of viruses versus organisms.
• **P** 1.13 -- I can construct an argument using evidence to compare and contrast the characteristics of viruses and organisms.

	• **R** 1.14 -- I can predict an organism's ability to survive within changing environmental limits • **P** 1.15 -- I can construct an explanation of how new understandings of Earth's history, the emergence of new species form pre-existing species, and our understanding of genetics have influenced our understanding of biology.	
Unit 2: Patterns in Living Systems **34 days** **Sep 24 – Nov 16**	**SB1**. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. a. Construct an explanation of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis. c. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes. (Clarification statement: The function of proteins as enzymes is limited to a conceptual understanding.) d. Plan and carry out investigations to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis. e. Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga). (Clarification statement: Instruction should focus on understanding the inputs, outputs, and functions of	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB1c** 2.3-Carbon Compounds (pg. 45-49) 8.1 Energy and Life (pg. 226-229) **SB1a, SB1d** 7.1-Life is Cellular (pg. 190-194) 7.2-Cell Structure (pg. 196-207) 19.3-Endosymbiosis (pg. 556-557) 7.3-Cell Transport (pg. 208-213) 7.4-Homeostasis and Cells (pg. 214-217) **SB1e** 8.2 Photosynthesis: An Overview (pg. 230-234) 8.3 The Process of Photosynthesis (pg. 235-241) 9.1- Cellular Respiration: An Overview (pg. 248-253) 9.2-The Process of Cellular Respiration (pg. 254-261) 9.3- Fermentation (pg. 262-265) **SB4a, SB4b, SB6b** 18.1- Finding Order in Diversity (pg. 510-515) 18.2-Modern Evolutionary Classification (pg. 516-522) 18.3- Building the Tree of Life (pg. 523-528) 19.2-Patterns and Processes of Evolution (pg. 546-552)

	photosynthesis and respiration and the functions of the major sub-processes of each including glycolysis, Krebs cycle, electron transport chain, light reactions, and Calvin cycle.) **SB4**. Obtain, evaluate, and communicate information to illustrate the organization of interacting systems within single-celled and multi-celled organisms. a. Construct an argument supported by scientific information to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea, bacteria, eukaryotes, fungi, plants, animals (Clarification statement: This is reflective of 21st century classification schemes and nested hierarchy of clades and is intended to develop a foundation for comparing major groups of organisms. The term 'protist' is useful in describing those eukaryotes that are not within the animal, fungal or plant clades but the term does not describe a well-defined clade or a natural taxonomic group.) b. Analyze and interpret data to develop models (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms. **SB6**. Obtain, evaluate, and communicate information to assess the theory of evolution. b. Analyze and interpret data to explain patterns in biodiversity that result from speciation.	

Learning Targets
K=Knowledge, R=Reasoning, S=Skill, P=Product
• **K** 2.1 -- I can describe the properties of carbon that allow it to form complex organic molecules.
• **K** 2.2 -- I can use laboratory tests to identify the four types of macromolecules.
• **K** 2.3 -- I can describe the structure, function, examples and sources of carbohydrates, lipids, proteins, and nucleic acids.
• **P** 2.4 -- I can describe how enzymes act as catalysts for biological reactions by lowering activation energy.
• **K** 2.5 -- I can discuss three characteristics of enzymes: 1.affected by pH & temperature 2.re-useable 3.substrate-specific
• **P** 2.6 -- I can construct an argument supported by evidence relating the structures of macromolecules to their functions.
• **K** 2.7 -- I can diagram and explain the ATP/ADP cycle.
• **K** 2.8 -- I can list the three statements of the cell theory, identify structures common to all cells, and distinguish between prokaryotes and eukaryotes.
• **R** 2.9 -- I can summarize the structure and function of organelles in eukaryotic cells including: nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, lysosomes, ER, and ribosomes.
• **K** 2.10 -- I can explain how cell structures interact as a system to maintain homeostasis
• **R** 2.11 -- I can discuss distinguishing characteristics of plant and animal cells.
• **R** 2.12 -- I can diagram cells in solutions and analyze the flow of water and solutes across membranes.
• **R** 2.13 -- I can compare and contrast passive and active transport and give specific examples of each.
• **K** 2.14 -- I can describe the role of active and passive transport in maintaining cellular homeostasis.

	• **K** 2.15 -- I can describe the overall function of photosynthesis: the reactants, products, organelles, and processes involved, including the light reactions and the Calvin cycle. • **K** 2.16 -- I can describe the overall function of respiration: the reactants, products, organelles, and processes involved, including glycolysis, the Kreb's cycle and the Electron transport Chain. • **R** 2.17 -- I can compare and contrast aerobic and anaerobic respiration, including fermentation, and describe the conditions under which each process occurs. • **K** 2.18 -- I can explain the roles and importance of photosynthesis and respiration in the cycling of matter and flow of energy within cells. • **R** 2.19 -- I can provide evidence to support the evolution of eukaryotes through endosymbiosis. • **K** 2.20 -- I can explain why evidence of evolution and patterns of common ancestry are the basis for the modern classification system. • **R** 2.21 -- I can interpret diagrams of evolutionary relationships, including cladograms and phylogenetic trees. • **R** 2.22 -- I can analyze and use data to develop cladograms and phylogenetic trees in order to show evolutionary relationships among organisms of common descent. • **R** 2.23 -- I can use data to explain how new species are formed, increasing earth's biodiversity. • K 2.24 -- I can define and give examples of types of evolution (convergent, divergent, coevolution, and adaptive radiation) that lead to increased biodiversity or speciation. • **S** 2.25 -- I can use the Linnean classification system to classify organisms. • **K** 2.26 -- I can use taxonomic characteristics to scientifically name an organism.	

Unit 3A: Structure and Function of Molecular Genetics **15 days** **Nov 26 – Dec 14** *Dec 17-20: Reserved for end of semester requirements*	**SB2.** Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. a. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation. b. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: • new genetic combinations through meiosis (crossing over, nondisjunction); • non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or • heritable mutations caused by environmental factors (radiation, chemicals, and viruses). **SB1.** Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. b. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB2a** 12.1-Identifying the Substance of Genes (pg. 338-343) 12.2-The Structure of DNA (pg. 344-348) 12.3-DNA Replication (pg. 350-353) 13.3-Mutations (pg. 372-373)-Gene Only **SB1b, SB2b** 10.1-Cell Growth, Division, and Reproduction (pg. 274-278) 10.2-The Process of Cell Division (pg. 279-285) 10.3-Regulating the Cell Cycle (pg. 286-290) 20.2-Prokaryotes (Binary Fission) (pg. 583) 11.4-Meiosis (pg. 332-329)-*Purpose and Overview Only*
Unit 3B: Structure and Function of Molecular Genetics, part 2 **20 days**	**SB2.** Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. a. Construct an explanation of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB2a, SB1c** 2.4-Enzymes (pg. 50-53) 13.1-RNA (pg. 362-365) 13.2-Ribosomes and Protein Synthesis (pg. 366-371) 20.1 Viruses (pg. 579)

Jan 4 – Feb 1	c. Ask questions to gather and communicate information about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture. (Clarification statement: The element is intended to include advancements in technology relating to economics and society such as advancements may include Genetically Modified Organisms.) **SB1.** Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. c. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes. (Clarification statement: The function of proteins as enzymes is limited to a conceptual understanding.)	**GAC ONLY**13.4-Gene Regulation and Expression (pg. 377-383) **SB2c** 14.3-Studying the Human Genome (pg. 403-409) 15.1-Selective Breeding (pg. 418-420) 15.2-Recombinant DNA (pg. 421-427) 15.3-Applications of Genetic Engineering (pg. 428-434) 15.4-Ethics and Impacts of Biotechnology (pg. 436-439)
Unit 4: Patterns of Heredity and Selection **25 days** **Feb 4 – Mar 15**	**SB1.** Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. b. Develop and use models to explain the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity. **SB2.** Obtain, evaluate, and communicate information to analyze how genetic information is expressed in cells. b. Construct an argument based on evidence to support the claim that inheritable genetic variations may result from: • new genetic combinations through meiosis (crossing over, nondisjunction); • non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB1b, SB2b** 14.1-Human Chromosomes (pg. 392-397) 11.4-Meiosis (pg. 332-329) 13.3-Mutations (pg. 374-376)-*Chromosomal* **SB3a, SB2b, SB3b, SB3c** 11.1-The Work of Gregor Mendel (pg. 308-312) Sexual Reproduction (pg. 277-278; 484; 558; 995) 11.2-Applying Mendel's Principles (pg. 313-318) 11.3-Other Patterns of Inheritance (pg. 319-321) **SB6a, SB6d** 17.1-Genes and Variation (pg. 482-486) 17.2-Evolution as Genetic Change in Populations (pg. 487-492)-Hardy Weinberg

	• heritable mutations caused by environmental factors (radiation, chemicals, and viruses). **SB3.** Obtain, evaluate, and communicate information to analyze how biological traits are passed on to successive generations. a. Use Mendel's laws (segregation and independent assortment) to ask questions and define problems that explain the role of meiosis in reproductive variability. b. Use mathematical models to predict and explain patterns of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.) c. Construct an argument to support a claim about the relative advantages and disadvantages of sexual and asexual reproduction. **SB6.** Obtain, evaluate, and communicate information to assess the theory of evolution. a. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology. d. Develop and use mathematical models to support explanations of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms. (Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.)	

Unit 5: Stability and Change in Ecosystems **15 days** **Mar 18 – Apr 12** *Apr 15 – EOC: Review for EOC* *After EOC: Remember some students will have the opportunity to retake the EOC—do not waste this time. Review areas where students are deficient or enrich students with additional Biology content.*	**SB5.** Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment. a. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.) b. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. • Arranging components of a food web according to energy flow. • Comparing the quantity of energy in the steps of an energy pyramid. • Explaining the need for cycling of major biochemical elements (C, O, N, P, and H). c. Construct an argument to predict the impact of environmental change on the stability of an ecosystem. d. Design a solution to reduce the impact of a human activity on the environment. (Clarification statement: Human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.) e. Construct explanations that predict an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire). **SB1.** Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells. c. Construct arguments supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids)	Curriculum Documents including learning targets, power points, labs, assessments, etc. **SB5a, SB5b, SB1c** *3.1-What is Ecology (pg. 64-68) **Review from Sem A* *3.2-Energy, Producers and Consumers (pg. 69-72) **Review from Sem A* 3.3-Energy Flow in Ecosystems (pg. 73-78) 3.4-Cycles of Matter (pg. 79-86) **SB5a** 4.2-Niches and Community Interactions (pg. 99-104) *5.1-How Populations Grow (pg. 130-135) *Review from Sem. A* *5.2-Limits to Population Growth (pg. 137-141) *Review from Sem. A* *5.3-Human Population Growth (pg. 142-145) *Review from Sem. A* **SB5c, SB5e** 4.1-Climate (pg. 96-98) 4.3-Succession (pg. 106-109) 4.4-Biomes (pg. 110-116) **Adaptations Only** 4.5-Aquatic Biomes (pg. 117-121) **Adaptations Only** **SB5d, SB6a** 6.1-A Changing Landscape (pg. 154-157) 6.2-Using Resources Wisely (pg. 158-165) 19.1 Life on a Changing Planet (pg. 544-545) 19.3-Geologic Time (pg. 560-563)

	to their interactions in carrying out cellular processes. (Clarification statement: The function of proteins as enzymes is limited to a conceptual understanding.) **SB6.** Obtain, evaluate, and communicate information to assess the theory of evolution. a. Construct an explanation of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology.	