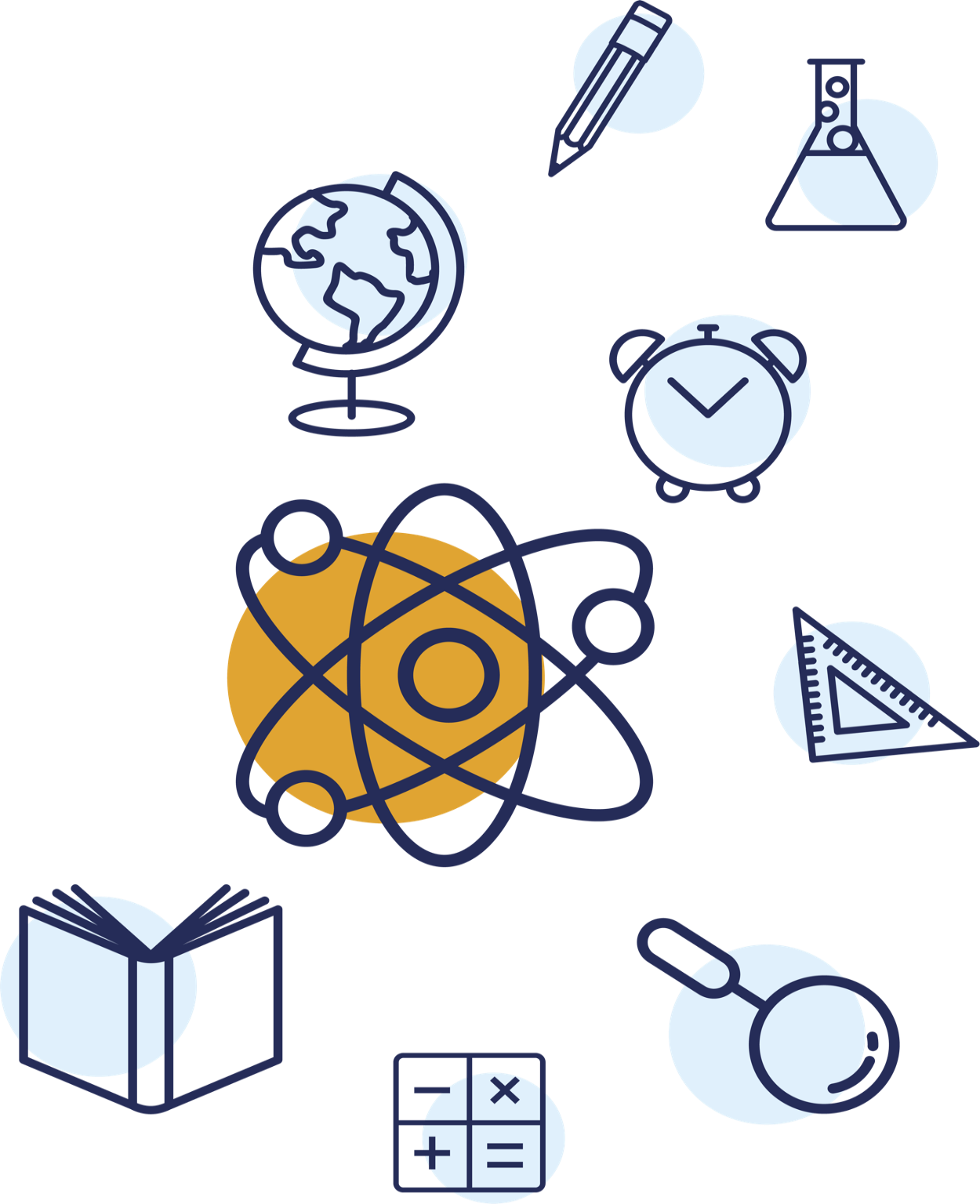
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**SUGGESTED**

**INSTRUCTIONAL PLANNING GUIDE**

*for the Mississippi College- and Career-Readiness Standards*

**q SCIENCE**

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| **FOUNDATIONS of BIOLOGY** |

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**Mississippi Department of Education**359 North West Street

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| **MISSISSIPPI DEPARTMENT OF EDUCATION** | |
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**INTRODUCTION**

The unprecedented, nationwide school closures in the spring of 2020 due to the COVID-19 pandemic have created a shift in how districts plan for school re-entry. Instead of the traditional brick-and-mortar planning, administrators are now identifying models that will support a variety of instructional delivery scenarios as they plan for school reopening. The traditional methods of planning and delivery are nearly impossible to implement as a stand-alone model; instead, innovative educators are developing and identifying strategies and resources to support a variety of distance learning scenarios as part of their plans. When using new models of delivery, it is important to recognize that the traditional approach to remediation—providing work better suited for earlier grades—may be insufficient. Instead, the conventional approach to remediation will likely compound the problem educators are trying to correct. According to a 2018 study, ***The Opportunity Myth***[[1]](#footnote-2), the approach of “meeting students where they are”, while often well-intended, only widens the achievement gap. Instead of remediation, teachers and administrators are encouraged to look toward acceleration methods to support student growth and close the gaps.

**PURPOSE**

The purpose of the Suggested Mississippi College- and Career-Readiness Standards Instructional Planning Guide is to provide teachers with an assistive tool for planning units of instruction. This tool will provide suggested standards grouping that should facilitate a coherent and logical delivery of related science concepts. Suggested planning sources and tools are included to assist teachers with curating instructional materials, designing and implementing effective lessons and activities, and building content knowledge and pedagogical practices. This tool encourages instructors to maintain a focus on preparing students to master skills and acquire knowledge at their current grade level.

**DEVELOPMENT**

The following suggested Instructional Planning Guide was developed with a focus on the subsequent key areas, Conceptual Connections, Real-World Connections and Phenomena, Embedded Science and Engineering Practices and Crosscutting Concepts, and Core Vocabulary. The standards are grouped into suggested units based on their underlying conceptual relationships. A list of real-world connections and/or phenomena is associated with each unit group. Their purpose is to give teachers and students researchable opportunities that lead to an in-depth and authentic quest for conceptual understanding. The embedded Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) are extracted from the grouped performance objectives and should encourage students to act and think like scientists. The included list of SEPs and CCCs does not indicate that other SEPs and CCCs are not relevant to the respective standard and performance objectives. Core vocabulary terms are included to emphasize terminology that is essential to the conceptual understandings captured in the standards and performance objectives. It is suggested that instructors pace themselves based on student assessment performance and demonstration of skills mastery and knowledge comprehension.

**RESOURCES for CONSIDERATION**

The resources listed below may be referenced to support classroom teachers in the development of lesson plans and instruction at the local level.   This list is not meant to be exhaustive, rather it represents consultative resources that align with the Units/Themes provided in the Instructional Planning Guides.   Educators are encouraged to use these resources in addition to those curriculum materials that meet the needs of the students they serve.

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| **High-Quality**  **Instructional Material**  **(HQIM)** | **Planning and Instruction Resources** | **Assessment**  **Resources** | **Professional Development**  **Resources** |
| * [Adopted Science Texts](https://mdek12.org/OEER/Caravan) * [STEM Teaching Tools](http://stemteachingtools.org/) | * [5 E Science Instructional Model](http://nextgenerationscience.weebly.com/5-es-of-science-instruction.html) * [The Concord Consortium](https://concord.org/ngss/) * [PBS Learning Media](https://mpb.pbslearningmedia.org/standards/0/) * [Teacher Tube](https://www.teachertube.com/) * [Next Generation Science Standards](https://www.nextgenscience.org/) * [Phenomena for Next Generation Science](https://www.ngssphenomena.com/) * [Khan Academy](https://www.khanacademy.org/) * [OpenSciEd](https://www.openscied.org/) * [Science Buddies](https://www.sciencebuddies.org/) * [PhET Interactive Simulations](https://phet.colorado.edu/) * [Phenomenal GRC Lessons](https://sites.google.com/3d-grcscience.org/going3d/home?authuser=0) | * [MS MAAP Program](https://mdek12.org/OSA/MAAP) * [MS MAAP-A Program](https://mdek12.org/OSA/SP/MAAP-A) * [Access for All Guidance](https://mdek12.org/sites/default/files/documents/OAE/OAE/2019-access-for-all-guide.pdf) * [Problem-Attic](https://www.problem-attic.com/) * [EDInformatics](https://www.edinformatics.com/testing/testing.htm) * [STEM Teaching Tools for Assessments](http://stemteachingtools.org/tgs/Assessment) * [Next Generation Science Assessment](http://nextgenscienceassessment.org/) (Middle Focus) | * [MDE Professional Development](https://www.mdek12.org/OPD/home) * [The Teaching Channel](https://www.teachingchannel.com/) * [California Academy of Sciences](https://www.calacademy.org/) * [Teacher Tube](https://www.teachertube.com/) * [Knowles Teacher Short Courses](https://knowlesteachers.org/knowles-academy/short-courses) * [STEM Teaching Tools OER PD](http://stemteachingtools.org/pd) |

| **FOUNDATIONS of BIOLOGY** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **SCIENCE FOUNDATION STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **COURSE INTRODUCTION**  Foundations of Biology, a one-credit course, is a research and inquiry-based course designed to give students the basic knowledge needed prior to attempting the rigorous Biology course required for graduation. This course is NOT a required prerequisite for Biology. However, if selected as a science elective, Foundations of Biology should not be taken after the successful completion of Biology. Concepts covered in this course include the history of biology and its impacts on society, the chemistry of life, organization and energy in living systems, the molecular basis of heredity, biological evolution, and ecological principals. | **FOUNDATION STANDARDS**   * Identify and select appropriate science and engineering tools to collect, analyze, and communicate science and engineering data and information. * Demonstrate effective questioning and observation skills * Communicate science and engineering data using appropriate SI units of measurement * Identify and discuss science and engineering practices * Identify and discuss Crosscutting Concepts   **OVERARCHING (start to finish) SEPs for INQUIRY EXTENSION of LABS**  Ask questions to generate hypotheses for scientific investigations based on empirical evidence and observations and/or ask questions to clarify or refine models, explanations, or designs.  Plan and conduct controlled scientific investigations to produce data to answer questions, test hypotheses and predictions, and develop explanations or evaluate design solutions, which require the following:   * Identify dependent and independent variables and appropriate controls * Select and use appropriate tools or instruments to collect data and represent data in an appropriate form * Analyze and interpret various types of data sets, using appropriate mathematic to verify or refute hypothesis or determine an optimal design solution * Construct an explanation of observed relationships between variables * Communicate scientific and/or technical information in various formats. | **SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Use Mathematical and Computational Thinking * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **SCIENCE CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Argument  Change  Concepts  Data  Dependent Variable  Engineering  Evaluate  Evidence  Gram  Independent Variable  Interpret  Investigation  Liter  Meter  Observation  Patterns  Quantity  Science  SI Units of Measurement  Stability |

| **TERM 1** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **HISTORY of BIOLOGY and IMPACTS on SOCIETY**  **Biology, A Historical Perspective**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss various historically relevant experiments by noted scientists and trace their findings to current application and studies. * Discuss current biological discoveries and discuss how they add to the continued study of life sciences. | **FB.1 Students will relate the importance of significant historical biological experiments and their impact of these on research, development, and society.**  **FB.1.1** Identify and communicate the contributions of famous scientists and their experiments that formed fundamental scientific principles (e.g., Robert Hooke, Schleiden/ Schwann/Virchow, Griffith, Avery/MacLeod/McCarty, Hershey/Chase, Rosalind Franklin, Gregor Mendel, Watson/Crick, Pasteur, and Charles Darwin).  **FB.1.2** Trace and model the historical development of scientific ideas and theories (e.g., creation of the microscope, discovery of cells/cell theory, discovery of DNA/RNA, double helical shape of DNA, evolution/natural selection, endosymbiosis) through the development of a timeline.  **FB.1.3** Research, analyze, explain, and communicate how scientific enterprise relates to society and classic inventions (e.g., microscope, blood typing, gel electrophoresis equipment, DNA sequencing technology).  **FB.1.4 Enrichment:** Research, analyze, explain, and communicate the influence of society, including cultural components, on the direction and progress of science and technology (e.g., medical treatments, emerging viruses, antibiotic resistance, vaccinations, and re-emergent diseases,  alternative energy development, and/or biomimicry. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Alfred Hershey  Biology  Cell Theory  Central Dogma  Charles Darwin  Deoxyribonucleic Acid  Disease  Evolution  Francis Crick  Gregor Mendel  James Watson  Louis Pasteur Vaccine  Martha Chase  Natural Selection  Organisms  Robert Hooke  Rosalind Franklin  Spontaneous Generation |
| **CHEMISTRY of LIFE**  **Matter: Structure and Interactions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Use various media to observe the unique bonding properties of carbon by examining various carbon-based compounds and substances to include diamonds, coal, and organic molecules. * Discuss commonly experienced conditions such as acid reflux with respect to changes in biological pH values. Identify problems and discuss possible solutions. | **FB.2 Students will demonstrate an understanding of the structure and interactions of matter and how the organization of matter supports living organisms.**  **FB.2.1** Develop and use simple atomic models to describe the components of elements (e.g., relative position, charges of protons, neutrons, and electrons).  **FB.2.2** Obtain and use information about elements (e.g., chemical symbol, atomic number, atomic mass, and group or family) to describe the organization of the periodic table.  **FB.2.3** Relate chemical reactivity to an element’s position on the periodic table. Use this information to determine what type of bond will form between elements (ionic, covalent, hydrogen).  **FB.2.4** Analyze and interpret data to classify common solutions as acids, bases, or neutral. Communicate the importance of pH in living systems. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Anion  Atom  Atomic Mass  Atomic Number  Cation  Compound  Covalent Bond  Electron  Element  Family (Group)  Hydrogen Bond  Ionic Bond  Neutron  Period  Proton |



| **TERM 2** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **CHEMISTRY of LIFE**  **Biological Compounds**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Observe the beading of water on leaves of plants and other substances and discuss relevant properties of water and other interactions of matter. * Research and discuss the diseases and disorders that occur due to the mis-function of various enzymes. | **FB.2 Students will demonstrate an understanding of the structure and interactions of matter and how the organization of matter supports living organisms.**  **FB.2.5** Investigate how the properties of water (e.g., cohesion, adhesion, heat capacity, solvent properties) contribute to the maintenance of living cells and organisms.  **FB.2.6** Explain the role of the major biomolecules (carbohydrates, proteins -including enzymes, lipids, and nucleic acids) to the survival of living organisms.  **FB.2.7 Enrichment:** Explore the structure of biomolecules using molecular models. Relate the structure of biomolecules to their function in living things (discuss types bonding, importance of the strength and weakness of the bond in function, energy in bonds, enzyme function). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Analyze and Interpret Data * Plan and Conduct Investigations * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Adhesion  Cohesion  Hydrogen Bond  Carbohydrate  Lipid  Protein  Nucleic Acid  Amino Acid  Enzyme  Specific Heat  Solvent |
| **ORGANIZATION & ENERGY in LIVING SYSTEMS**  **Cellular Organization and Functions**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Examine cells by preparing sections of local plants and create models based on observed cellular structures. Examine human cheek cells in the same manner. Various media may be utilized as well. * Research and discuss the vast number of eukaryotic cells in the human body (200 plus). Compare the largest human cell and the smallest human cell and develop an argument that speaks to this difference. | **FB.3 Students will demonstrate an understanding of how the structure of living organisms supports the essential functions of life.**  **FB.3.1** Compare and contrast prokaryotic/eukaryotic and plant/animal/bacteria cells.  **FB.3.2** Use models to investigate and explain structures within living cells that support life (e.g., cytoplasm, cell membrane, cell wall, nucleus, mitochondria, chloroplasts, lysosomes, Golgi, vacuoles, ER, ribosomes, chromosomes, centrioles, cytoskeleton, nucleolus, nuclear membrane). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Animal Cell/Plant Cell  Bacteria  Cellular Organelle (define all)  Lysosome  Prokaryote  Nucleus  Nucleolus  Chloroplast  Vacuole  Mitochondria  Eukaryote  Centriole  Ribosome  Endoplasmic Reticulum  Golgi Body (Apparatus |
| **ORGANIZATION & ENERGY in LIVING SYSTEMS**  **Functions of Living Organisms**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss the mechanics of controlling glucose levels in the body with respect to the conceptual understandings of cellular transport mechanisms. * Research mitosis-driven regeneration in lizards and how this process is being studied for human application. | **FB.3 Students will demonstrate an understanding of how the structure of living organisms supports the essential functions of life.**  **FB.3.3** Compare and contrast active and passive cellular transport. Analyze the movement of water across a cell membrane in hypotonic, isotonic, and hypertonic solutions.  **FB.3.4** Analyze the relationship between photosynthesis and cellular respiration and explain that relationship in terms of the need for all living things to acquire energy from their environment.  **FB 3.5** Use models to explain how ADP and ATP cycle to store and release chemical energy using inorganic phosphate.  **FB.3.6** Compare and contrast the processes and results of mitosis and meiosis.  **FB.3.7 Enrichment:** Research and orally communicate the possible outcomes of a failure of mitosis (cancer) or meiosis (nondisjunction). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data   Construct Explanations and Design Solutions   * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Scale, Proportion, and Quantity * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Photosynthesis  Cellular Respiration  Mitosis  Meiosis  Active Transport  Hypertonic  Hypotonic  Isotonic  Passive Transport  Facilitated Diffusion  Diffusion  Osmosis |

| **TERM 3** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **MOLECULAR BASIS of HEREDITY**  **Inheritance and Genetics**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Discuss the ethical issues that may surround over-the-counter DNA testing as part the larger human genome mapping movement. * Observe various media showing groups of offspring displaying codominant traits and determine possible parent genes * Research and discuss disease and disorders resulting from genetic mutations. | **FB.4 Students will demonstrate an understanding of how genetic information is transferred from parent to offspring.**  **FB.4.1** Compare and contrast the basic structure and function of nucleic acids (e.g., DNA, RNA).  **FB.4.2** Obtain and communicate information illustrating the relationships among DNA, genes, chromosomes, and proteins to the basis of life.  **FB.4.3** Use models (e.g., Punnett squares) and mathematical reasoning to describe and predict patterns of inheritance of single genetic traits from parents to offspring (e.g., dominant, and recessive traits, incomplete dominance, codominance, multiple alleles, sex- linkage).  **FB.4.4** Obtain and communicate information to describe how mutations may affect genetic expression and provide examples. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Plan and Conduct Investigations * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Structure and Function * Stability and Change | Allele  Chromosome  Co-dominance  Dominant Trait  Gene  Generation  Genotype  Incomplete Dominance  Heterozygous  Homozygous  Phenotype  Recessive Trait  Sex-linked |
| **MOLECULAR BASIS of HEREDITY**  **Inheritance and Genetics**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss advances made in cloning animals such as sheep and monkeys. What are the moral and ethical implications? What technology makes this possible? * Discuss how DNA technology allows for early detection of genetic disorders. | **FB.4 Students will demonstrate an understanding of how genetic information is transferred from parent to offspring.**  **FB.4.5** Research and report genetic technologies that may improve the quality of life (e.g., genetic engineering, cloning, gene splicing, DNA testing).  **FB.4.6** **Enrichment:** Debate the pros and cons of using biotechnology to manipulate genetic information for human purpose (society). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Structure and Function * Stability and Change | Cloning  Gene Modification  Gene Splicing  Genetic Engineering  Genetic Modification  Recombinant DNA |
| **BIOLOGICAL EVOLUTION**  **Evolution of Species**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Critique research studies that examine the relationship between modern and pre-historic species to show ancestral connections and evolution by studying fossil records. | **FB.5 Students will demonstrate an understanding of Earth’s fossil record and its indication of the diversity of life over time.**  **FB.5.1** Investigate through research the contributions of scientists to the theory of evolution and evolutionary processes (e.g., Needham, Spallanzani, Redi, Pasteur, Lyell, Lamarck, Malthus, Wallace, Darwin).  **FB.5.2** Analyze and interpret data to support claims that different types of fossils provide evidence of the diversity of life that has existed on Earth and of the relationships between past and existing life on Earth.  **FB.5.3** Obtain and communicate information to explain how DNA evidence and fossil records support Darwin’s theory of evolution. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Energy and Matter *(Flows, Cycles, Conservation)* * Structure and Function * Stability and Change | Analogous Structures  Biogenesis  Diversity  Embryology  Evolution  Fossil  Fossil Record  Homologous Structures  Speciation  Species  Spontaneous Generation  Vestigial Structures |

| **TERM 4** | | | |
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| **UNIT OF STUDY**  (REAL-WORLD CONNECTIONS and PHENOMENA)  **q** | **MS CCR STANDARDS q** | **SCIENCE AND ENGINEERING PRACTICES  SCIENCE CROSSCUTTING CONCEPTS**  **q** | **VOCABULARY TERMS** CORE ACADEMIC  **q** |
| **BIOLOGICAL EVOLUTION**  **Diversity, Adaptations, and Natural Selection**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research the impact of low genetic diversity on the survival of a selected species * Research and discuss the survival of Buffalo Grass in unsuitable mining areas. | **FB.5 Students will demonstrate an understanding of Earth’s fossil record and its indication of the diversity of life over time.**  **FB.5.4** Investigate how biological adaptations and genetic variations of traits in a population enhance the probability of survival in an environment (natural selection).  **FB.5.5 Enrichment:** Create and analyze models that illustrate the relatedness between all living things (cladograms/phylogenic trees). | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Plan and Conduct Investigations * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Structure and Function * Stability and Change | Adaptation  Diversity  Extinction  Gene Pool  Generation  Natural Selection  Population  Selective Breeding  Variation |
| **ECOLOGICAL PRINCIPLES**  **Ecological Systems**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Research and discuss the impact of natural disasters on local ecosystems to include changes in habitats of various species. * Examine the effects of prolonged climate change on agriculture in Mississippi and explore the idea of Climate-Smart Agriculture. | **FB.6 Students will understand the interdependence of living organisms and their environment.**  **FB 6.1** Compare and contrast biotic and abiotic factors.  **FB 6.2** Use models to analyze the cycling of matter in an ecosystem (e.g., water, carbon dioxide/oxygen, nitrogen).  **FB.6.3** Obtain, evaluate, and communicate information to explain relationships that exist between abiotic and biotic components of an ecosystem. Explain how changes in biotic and abiotic components affect the balance of an ecosystem over time.  **FB 6.4** Develop and use models to discuss the climate, flora, and fauna of the terrestrial and aquatic biomes of the world. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Engage in Scientific Argument from Evidence * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Abiotic Factor  Biotic Factor  Biome  Biomass  Flora Biome  Fauna Biome  Aquatic Biome  Ecosystem  Interdependence |
| **ECOLOGICAL PRINCIPLES**  **Interdependence of Living Things**  **REAL-WORLD CONNECTIONS and PHENOMENA**   * Discuss the impact of growing human population and progress on natural habitats in local ecosystems. * Research and examine the agricultural and economic impacts of invasive plants species in Mississippi. | **FB.6 Students will understand the interdependence of living organisms and their environment.**  **FB 6.5** Use models to analyze the flow of energy through food chains, webs, and pyramids.  **FB 6.6** Engage in scientific argument from evidence to distinguish organisms that exist in symbiotic (mutualism, parasitism, commensalism) or co-evolutionary (predator-prey, cooperation, competition, and mimicry) relationships within ecosystems.  **FB 6.7 Enrichment:** Design solutions to reduce the impact of human activity on the ecosystem. | **EMBEDDED SCIENCE and ENGINEERING PRACTICES**   * Ask Question and Define Problems * Develop and Use Models * Analyze and Interpret Data * Engage in Scientific Argument from Evidence * Construct Explanations and Design Solutions * Obtain, Evaluate, and Communicate Information   **EMBEDDED CROSSCUTTING CONCEPTS**   * Patterns * Cause and Effect *(Mechanism and Explanation)* * Systems and System Models * Energy and Matter *(Flows, Cycles, Conservation)* * Stability and Change | Autotroph  Biomass  Commensalism  Competition  Consumers  Energy  Food Chain  Heterotroph  Mimicry  Mutualism  Predator  Producer |

1. https://tntp.org/assets/documents/TNTP\_The-Opportunity-Myth\_Web.pdf [↑](#footnote-ref-2)