

This crosswalk is intended to show many of the possible connections between the *Rx for Science Literacy* manual and the standards across many of the curricula areas taught in the state of North Carolina.* This manual contains many lessons that strengthen the knowledge of biomedical research. The lessons in this manual may be taught sequentially or independently. The materials provided in the manual are the basis for the lessons. Teachers are expected to make the necessary adjustments to these lesson plans to meet the needs of their students.

**Updated to reflect 2023 North Carolina Essential Standards in Science.*

Unit I-Chapter 1 What is Science?

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade
- Writing Standards Text Types and Purposes 1 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for

Kindergarten to Twelfth grade

North Carolina Essential Standards for Social Studies

- **6.H.1** Understand the development of civilizations and societies from various perspectives.
- **7.H.1** Evaluate historical and current events from a variety of perspectives.

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Foundations of Health Science
 - » **HU10 2.03** Research men and women who made historical contributions to health care.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit I-Chapter 2

What is Biomedical Research?

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems

relevant to the problem.

- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.3.1** Understand human body systems and how they are essential for life: protection, movement, and support. **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.8.1** Understand the hazards caused by agents of diseases that affect living organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade
- Writing Standards Text Types and Purposes 1 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Kindergarten to Twelfth grade

North Carolina Essential Standards for Social Studies

- **6.H.1** Understand the development of civilizations and societies from various perspectives.
- **7.H.1** Evaluate historical and current events from a variety of perspectives.

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Exploring Healthcare Diagnostic Careers
 - » **HU052YD 4.01** Identify structures and functions of the cardiovascular system.
- Biomedical Technology

- » **HB11 1.00** Understand biomedical research.
- Agriscience Applications
- » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit I-Chapter 3 Biomedical Research Methods

Next Generation Science Standards

- **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-3.** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

North Carolina Essential Standards for Science

- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of

inheritance, and potential variation among offspring.

- **LS.8.1** Understand the hazards caused by agents of diseases that affect living organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Kindergarten to Twelfth grade

North Carolina Essential Standards for Social Studies

- **6.H.1** Understand the development of civilizations and societies from various perspectives.
- **7.H.1** Evaluate historical and current events from a variety of perspectives.

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Exploring Healthcare Diagnostic Careers
 - » **HU052YD 4.01** Identify structures and functions of the cardiovascular system.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 5.06** Vaccinations and Prevention of Infectious Diseases.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit I-Chapter 4 Benefits of Biomedical Research

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision

to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **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-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-3.** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

North Carolina Essential Standards for Science

- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.8.1** Understand the hazards caused by agents of diseases that affect living organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.
- **LS.Bio.7** Understand types of inheritance and how the environment can influence traits.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Kindergarten to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Kindergarten to Twelfth grade

North Carolina Essential Standards for Social Studies

- **6.H.1** Understand the development of civilizations and societies from various perspectives.
- **7.H.1** Evaluate historical and current events from a variety of perspectives.

Common Core State Standards for Mathematics

- **8.SP** Statistics and Probability
- **S-ID** Interpreting Categorical and Quantitative Data

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 5.06** Vaccinations and Prevention of Infectious Diseases.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit II-Chapter 1 Student Surveys

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 7, 8 and 9 for Sixth grade to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Kindergarten to Twelfth grade

Common Core State Standards for Mathematics

- **8.SP** Statistics and Probability
- **S-ID** Interpreting Categorical and Quantitative Data

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 2.00** Understand the use and care of animals in biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit II-Chapter 2 Why Use Animals?

Next Generation Science Standards

- **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 2.00** Understand the use and care of animals in biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit II-Chapter 3 Advances Based on Animal Research

Next Generation Science Standards

- **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Fourth grade to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 2.00** Understand the use and care of animals in biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit II-Chapter 4 Number and Species of Animals Used

Next Generation Science Standards

- **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
 - **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
 - **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
 - **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
 - **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
 - **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
 - **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
 - **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
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North Carolina Essential Standards for Science

- **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
 - **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
 - **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
 - **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.
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Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Fourth grade to Twelfth grade
 - Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Fourth grade to Twelfth grade
 - Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Fourth grade to Twelfth grade
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Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.

- Biomedical Technology
 - » **HB11 2.00** Understand the use and care of animals in biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit II-Chapter 5 Care of Research Animals

Next Generation Science Standards

- **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.5.2** Understand the interdependence of plants and animals with their ecosystem.
- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.Bio.5.2** Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Ninth grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Ninth grade to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Ninth grade

to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 2.02** Care of animals in biomedical research
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
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AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit III-Chapter 1

Critical Thinking

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

North Carolina Essential Standards for Science

- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
- **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
- **LS.8.1** Understand the hazards caused by agents of diseases that affect living organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.

- **LS.Bio.7** Understand types of inheritance and how the environment can influence traits.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Fifth grade to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Fifth grade to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 2.00** Understand the use and care of animals in biomedical research.
 - » **HB11 3.03** Genetically Modified Organisms
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit III-Chapter 2

Animal Research: Issues and Answers

Next Generation Science Standards

- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-LS3-1.** Ask questions to clarify relationships about the role of DNA and chromosomes

encoding the instructions for characteristic traits passed from parents to offspring.

- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
 - **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
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North Carolina Essential Standards for Science

- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
 - **LS.Bio.8** Understand the applications of genetics and biotechnology.
-

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Ninth grade to Twelfth grade
 - Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Ninth grade to Twelfth grade
 - Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Ninth grade to Twelfth grade
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Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.00** Understand the challenges of biomedical research.
 - » **HB11 5.06** Vaccinations and Prevention of Infectious Diseases.
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
-

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit III-Chapter 3
Transgenic Animals

Next Generation Science Standards

- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-LS3-1.** Ask questions to clarify relationships about the role of DNA and chromosomes encoding the instructions for characteristic traits passed from parents to offspring.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
- **LS.Bio.6** Understand genetic mechanisms for variation.
- **LS.Bio.7** Understand types of inheritance and how the environment can influence traits.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Ninth grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Ninth grade to

Twelfth grade

- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Ninth grade to Twelfth grade
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Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.00** Understand the challenges of biomedical research.
 - » **HB11 2.03** Emerging Issues in Biomedical Research.
 - » **HB11 3.03** Genetically Modified Organisms.
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
-

AP Biology

- **Science Practice 1** Concept Explanation
 - **Science Practice 2** Visual Representation
 - **Science Practice 4** Representing and Describing Data
 - **Unit 5** Heredity
-

Unit III-Chapter 4

Therapeutic vs. Reproductive Cloning: Scientific Realities, Public Controversy

Next Generation Science Standards

- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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.

- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-LS3-1.** Ask questions to clarify relationships about the role of DNA and chromosomes encoding the instructions for characteristic traits passed from parents to offspring.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

North Carolina Essential Standards for Science

- **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
- **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life.
- **LS.Bio.6** Understand genetic mechanisms for variation.
- **LS.Bio.7** Understand types of inheritance and how the environment can influence traits. **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Ninth grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Ninth grade to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Ninth grade to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.02** Therapeutic vs. Reproductive Cloning.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit IV-Chapter 1 Careers in the Biosciences

Next Generation Science Standards

- **MS-LS1-3.** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

North Carolina Essential Standards for Science

- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Third grade to Twelfth grade
- Writing Standards Text Types and Purposes 1 for Third grade to Twelfth grade
- Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Third grade to Twelfth grade
- Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Third grade to Twelfth grade

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Foundation of Health Science
 - » **HU10 2.04** Explore current trends in health care
 - » **HU10 5.00** Analyze medical and health care careers
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.00** Understand the challenges to biomedical research.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data

Unit IV-Chapter 2
Genetics Primer

Next Generation Science Standards

- **MS-LS1-1.** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- **MS-LS3-1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- **MS-LS3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-5.** Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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.
- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
 - **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-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
-

North Carolina Essential Standards for Science

- **LS.7.1** Understand the processes, structures and functions of living organisms that enable them to survive, reproduce and carry out the basic functions of life.
 - **LS.7.2** Understand the relationship of the mechanisms of reproduction, patterns of inheritance, and potential variation among offspring.
 - **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
 - **LS.Bio.1.1** Construct explanations to illustrate relationships between structure and function of major macromolecules essential for life
 - **LS.Bio.6** Understand genetic mechanisms for variation.
 - **LS.Bio.7** Understand types of inheritance and how the environment can influence traits.
 - **LS.Bio.8** Understand the applications of genetics and biotechnology.
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Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

- Reading Standards for Informational Text 1, 2, 3 and 4 for Ninth grade to Twelfth grade
 - Speaking and Listening Standards Comprehension and Collaboration 1, 2 and 3 for Ninth grade to Twelfth grade
 - Speaking and Listening Standards Presentation of Knowledge and Ideas 4, 5 and 6 for Ninth grade to Twelfth grade
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Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - » **AU022YB 6.00** Understand the science of plants in agricultural biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Foundations of Health Science
 - » **HU10 2.03** Research men and women who made historical contributions to health care.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.01** Genetic Primer
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
-

AP Biology

- **Science Practice 1** Concept Explanation

- **Science Practice 2** Visual Representation
 - **Science Practice 4** Representing and Describing Data
 - **Unit 5** Heredity
-

Unit IV-Chapter 3 Nanobiotechnology

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
 - **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
 - **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
 - **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
 - **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
 - **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
 - **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
 - **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
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North Carolina Essential Standards for Science

- **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
 - **LS.Bio.8** Understand the applications of genetics and biotechnology.
-

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Foundation of Health Science
 - » **HU10 2.05** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.05** Nanobiotechnology.
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
-

AP Biology

- **Science Practice 1** Concept Explanation
 - **Science Practice 2** Visual Representation
 - **Science Practice 4** Representing and Describing Data
 - **Unit 5** Heredity
-

Unit IV-Chapter 4 Regenerative Medicine

Next Generation Science Standards

- **MS-LS1-1.** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- **MS-LS3-1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- **MS-LS3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **MS-LS4-5.** Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- **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.

- **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-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **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-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-LS2-7.** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **HS-LS3-1.** Ask questions to clarify relationships about the role of DNA and chromosomes encoding the instructions for characteristic traits passed from parents to offspring.
- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- **HS-ESS3-3.** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- **HS-ESS3-4.** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

North Carolina Essential Standards for Science

- **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
- **LS.Bio.2** Analyze the growth and development processes of organisms.
- **LS.Bio.8** Understand the applications of genetics and biotechnology.

Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
- Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
- Foundation of Health Science
 - » **HU10 2.04** Explore current trends in health care.
- Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 3.04** Regenerative Medicine.
- Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.

AP Biology

- **Science Practice 1** Concept Explanation
- **Science Practice 2** Visual Representation
- **Science Practice 4** Representing and Describing Data
- **Unit 5** Heredity

Unit IV-Chapter 5 New Technologies in Vaccines

Next Generation Science Standards

- **MS-ESS3-3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
 - **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
 - **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
 - **MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
 - **HS-ETS1.1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
 - **HS-ETS1.2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
 - **HS-ETS1.3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
 - **HS-ETS1.4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
 - **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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North Carolina Essential Standards for Science

- **LS.Bio.1** Analyze how the relationship between structure and function supports life processes within organisms.
 - **LS.Bio.4** Analyze the relationships between matter and energy within ecosystems.
 - **LS.Bio.8** Understand the applications of genetics and biotechnology.
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Career and Technical Education Course Blueprint Competencies

- Exploring Animal and Plant Science
 - » **AU022YB 5.00** Analyze the fundamental components of biotechnology.
 - Exploring Agricultural Issues
 - » **AU022YD 8.02** Understand concepts and issues related to biotechnology and other emerging technologies in the agricultural industry.
 - Foundation of Health Science
 - » **HU10 2.04** Explore current trends in health care.
 - Biomedical Technology
 - » **HB11 1.00** Understand biomedical research.
 - » **HB11 5.06** Vaccinations and Prevention of Infectious Diseases.
 - Agriscience Applications
 - » **AU10 4.02** Understand biotechnology in the animal industry.
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AP Biology

- **Science Practice 1** Concept Explanation

- **Science Practice 2** Visual Representation
 - **Science Practice 4** Representing and Describing Data
 - **Unit 5** Heredity
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