

Inquiry Investigations™
Biotechnology Techniques MODULE - 1278357
Grades: 7-10

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Arkansas Curriculum Frameworks
Science
Grade 7

STRAND/CONTENT STANDARD	AR. 1.	Nature of Science: Characteristics and Processes of Science: Students shall demonstrate and apply knowledge of the characteristics and processes of science using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.1.	Processes of Science: Interpret evidence based on observations <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.2.	Processes of Science: Analyze components of experimental design used to produce empirical evidence: hypothesis, replication, sample size, appropriate use of control, use of standardized variables <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using

		<p>Restriction Enzymes to Cut DNA Strands</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.3.	<p>Processes of Science: Interpret scientific data using mean, median, mode, and range using SI units</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.4.	<p>Processes of Science: Construct and interpret scientific data using histograms, circle graphs, scatter plots, double line graphs, line graphs by approximating line of best fit</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.5.	<p>Processes of Science: Communicate results and conclusions from scientific inquiry</p>

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.7.6.	<p>Processes of Science: Develop and implement strategies for long-term, accurate data collection</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT	NS.1.7.7.	<p>Characteristics of Science: Distinguish between questions that can and</p>

LEARNING EXPECTATION		<p>cannot be answered by science</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STRAND/CONTENT STANDARD	AR.3.	Life Science: Life Cycles, Reproduction, and Heredity: Students shall demonstrate and apply knowledge of life cycles, reproduction, and heredity using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	LS.3.7.8.	<p>Heredity and Reproduction: Identify the number and source of chromosomes in human body cells</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.5.	Physical Science: Matter: Properties and Changes: Students shall demonstrate and apply knowledge of matter, including properties and changes, using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	PS.5.7.1.	<p>Properties of Matter: Explain how a small number of naturally-occurring elements can result in the large variety of substances found in the world</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments
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Arkansas Curriculum Frameworks
Science
Grade 8

STRAND/CONTENT STANDARD	AR. 1.	Nature of Science: Characteristics and Processes of Science: Students shall demonstrate and apply knowledge of the characteristics and processes of science using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.1.	<p>Processes of Science: Justify conclusions based on appropriate and unbiased observations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.2.	<p>Processes of Science: Evaluate the merits of empirical evidence based on experimental design: hypothesis, replication, sample size, appropriate use of control, use of standardized independent and dependent variables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.3.	<p>Processes of Science: Formulate a testable problem using experimental design</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.4.	<p>Processes of Science: Analyze a set of scientific data using mean, median, mode, and range using SI units</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.5.	<p>Processes of Science: Suggest solutions to real world problems by analyzing scientific data in data tables/charts, histograms, circle graphs, scatter plots, stem and leaf plots, line and double line, graphs by approximating line of best fit</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.7.	<p>Processes of Science: Communicate results and conclusions from scientific inquiry following peer review</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1:

		<ul style="list-style-type: none"> Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.8.	<p>Processes of Science: Develop and implement strategies for long-term, accurate data collection</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.1.8.9.	<p>Characteristics of Science: Generate questions that can and cannot be answered by science</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA

		<p>Structure and Replication</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STRAND/CONTENT STANDARD	AR.2.	Life Science: Living Systems: Characteristics, Structure, and Function: Students shall demonstrate and apply knowledge of living systems using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	LS.2.8.7.	<p>Structure and Function: Classify cells as eukaryotic or prokaryotic</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.3.	Life Science: Life Cycles, Reproduction, and Heredity: Students shall demonstrate and apply knowledge of life cycles, reproduction, and heredity using appropriate safety procedures, equipment, and technology
STANDARD/STUDENT LEARNING EXPECTATION	LS.3.8.1.	<p>Heredity and Reproduction: Identify and explain why inherited characteristics of living things depend on genes</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	LS.3.8.7.	<p>Heredity and Reproduction: Conduct investigations demonstrating that the phenotype of a genetic trait is the result of genotype</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	LS.3.8.10.	<p>Heredity and Reproduction: Distinguish between characteristics of plants and animals through selective breeding</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	LS.3.8.11.	<p>Heredity and Reproduction: Investigate careers, scientists, and historical breakthroughs related to genetics</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
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**Arkansas Curriculum Frameworks
Science
Grade 9**

STRAND/CONTENT STANDARD	AR.2.AP.	Anatomy and Physiology: Cellular Chemistry: Students shall understand the role of chemistry in body processes.
STANDARD/STUDENT LEARNING EXPECTATION	CC.2.AP.9	<p>Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	CC.2.AP.10	<p>Describe the characteristics and importance of enzymes</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.3.AP.	Anatomy and Physiology: Anatomy and Physiology of the Cell: Students shall understand that cells are the basic, structural, and functional units of life.
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.1	<p>Explain the structure and function of the plasma membrane</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.2	<p>Compare and contrast the different ways in which substances cross the plasma membrane: diffusion and osmosis, facilitated diffusion, active transport, filtration, endocytosis, exocytosis</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2:

		Extracting Cellular DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.3	Describe the structure and function of organelles and cell parts <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.4	Identify chemical substances produced by cells <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.5	Differentiate among replication, transcription, and translation <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.6	Differentiate between mitosis and meiosis <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.17.AP.	Anatomy and Physiology: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.2	Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1:

		<p>Determining Molecular Mass and Charge</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.4	<p>Gather and analyze data using appropriate summary statistics</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.5	<p>Formulate valid conclusions without bias</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.6	<p>Communicate experimental results using appropriate reports, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2:

		<p>Extracting Cellular DNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.18.AP.	Anatomy and Physiology: Nature of Science: Students shall demonstrate an understanding of current life science theories.
STANDARD/STUDENT LEARNING EXPECTATION	NS.18.AP.2	<p>Relate the development of the cell theory to current trends in cellular biology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA • Virtual Laboratory: Restriction Enzyme Cleavage of DNA

STANDARD/STUDENT LEARNING EXPECTATION	NS.18.AP.4	<p>Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome therapy)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.19.AP.	Anatomy and Physiology: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.19.AP.1	<p>Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1:

		<p>Turning Genes On and Off</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
<p>STANDARD/STUDENT LEARNING EXPECTATION</p>	<p>NS.19.AP.2</p>	<p>Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
<p>STANDARD/STUDENT LEARNING EXPECTATION</p>	<p>NS.19.AP.3</p>	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.20.AP.	Anatomy and Physiology: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.20.AP.2	<p>Discuss why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.20.AP.3	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.1.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of the role of chemistry in life processes.
STANDARD/STUDENT LEARNING EXPECTATION	MC.1.B.1	<p>Describe the structure and function of the major organic molecules found in living systems: carbohydrates, proteins, enzymes, lipids, nucleic acids</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.1.B.2	<p>Describe the relationship between an enzyme and its substrate molecule(s)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.2.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of the structure and function of cells.
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.2	<p>Compare and contrast prokaryotes and eukaryotes</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.3	<p>Describe the role of sub-cellular structures in the life of a cell: organelles, ribosomes, cytoskeleton</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.4	<p>Relate the function of the plasma (cell) membrane to its structure</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.5	<p>Compare and contrast the structures of an animal cell to a plant cell</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.10	<p>Analyze the meiotic maintenance of a constant chromosome number from one generation to the next</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.3.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
STANDARD/STUDENT LEARNING EXPECTATION	MC.3.B.1	<p>Compare and contrast the structure and function of mitochondria and chloroplasts</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.4.B.	Biology: Heredity and Evolution: Students shall demonstrate an understanding of heredity.
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.1	<p>Summarize the outcomes of Gregor Mendel's experimental procedures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.2	<p>Differentiate among the laws and principles of inheritance: dominance, segregation, independent assortment</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.4	<p>Examine different modes of inheritance: sex linkage, codominance, crossing over, incomplete dominance, multiple alleles</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2:

		<p>Extracting Cellular DNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.5.B.	Biology: Heredity and Evolution: Students shall investigate the molecular basis of genetics.
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.1	<p>Model the components of a DNA nucleotide and an RNA nucleotide</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.2	Describe the Watson-Crick double helix model of DNA, using the base-pairing rule (adenine-thymine, cytosine-guanine)

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.3	<p>Compare and contrast the structure and function of DNA and RNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.4	Describe and model the processes of replication, transcription, and

		<p>translation</p> <ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.7.B.	Biology: Classification and the Diversity of Life: Students shall demonstrate an understanding that organisms are diverse.
STANDARD/STUDENT LEARNING EXPECTATION	CDL.7.B.9	<p>Classify bacteria according to their characteristics and adaptations</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	CDL.7.B.10	<p>Evaluate the medical and economic importance of bacteria</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STRAND/CONTENT STANDARD	AR.9.B.	Biology: Ecology and Behavioral Relationships: Students shall demonstrate an understanding of the ecological impact of global issues.
STANDARD/STUDENT LEARNING EXPECTATION	EBR.9.B.3	<p>Assess current world issues applying scientific themes (e.g., global changes in climate, epidemics, pandemics, ozone depletion, UV radiation, natural resources, use of technology, and public policy)</p> <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.11.B.	Biology: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.1	<p>Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1:

		Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.2	<p>Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.4	<p>Gather and analyze data using appropriate summary statistics</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.5	<p>Formulate valid conclusions without bias</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1:

		<p>Engineering Recombinant DNA Molecules</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.6	<p>Communicate experimental results using appropriate reports, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.12.B.	Biology: Nature of Science: Students shall demonstrate an understanding of current life science theories.
STANDARD/STUDENT LEARNING EXPECTATION	NS.12.B.4	<p>Relate the development of the cell theory to current trends in cellular biology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA

STANDARD/STUDENT LEARNING EXPECTATION	NS.12.B.6	<p>Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome therapy)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.13.B.	Biology: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.1	<p>Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.2	<p>Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.3	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.14.B.	Biology: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.14.B.2	<p>Discuss why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.14.B.4	Explain how the cyclical relationship between science and technology

		<p>results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.9.C.	Chemistry: Bonding: Students shall understand the process of covalent bonding.
STANDARD/STUDENT LEARNING EXPECTATION	B.9.C.4	<p>Identify the strengths and effects of intermolecular forces (van der Waals): hydrogen bonding, dipole-dipole, dipole-induced dipole, dispersion forces (London)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication
STRAND/CONTENT STANDARD	AR.22.C.	Chemistry: Acids and Bases: Students shall demonstrate an understanding of titration as a laboratory tool.
STANDARD/STUDENT LEARNING EXPECTATION	AB.22.C.3	<p>Investigate the role of buffers</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
STRAND/CONTENT STANDARD	AR.29.C.	Chemistry: Organic Chemistry: Students shall demonstrate an understanding of the role of organic compounds in living and non-living systems.
STANDARD/STUDENT LEARNING EXPECTATION	OC.29.C.1	<p>Differentiate among the biochemical functions of proteins, carbohydrates, lipids, and nucleic acids</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA

STANDARD/STUDENT LEARNING EXPECTATION	OC.29.C.2	Describe the manufacture of polymers derived from organic compounds: polymerization, crosslinking <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication
STRAND/CONTENT STANDARD	AR.33.C.	Chemistry: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.33.C.2	Research and apply appropriate safety precautions (refer to Arkansas Safety Lab Guide) when designing and/or conducting scientific investigations <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.36.C.	Chemistry: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.36.C.4	Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.1.ES.	Environmental Science: Physical Dynamics: Students shall understand the physical dynamics of Earth
STANDARD/STUDENT LEARNING EXPECTATION	PD.1.ES.11	Describe the physical and chemical properties of water <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments
STRAND/CONTENT STANDARD	AR.3.ES.	Environmental Science: Social Perspectives: Students shall understand the impact of human activities on the environment.
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.9	Evaluate personal and societal benefits when examining health, population, resource, and environmental issues <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.10	Predict the long-term societal impact of specific health, population, resource, and environmental issues <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.11	Investigate the effect of public policy decisions on health, population, resource, and environmental issues <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.4.ES.	Environmental Science: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve environmental science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.1	Collect and analyze scientific data using appropriate mathematical calculations, figures and tables <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1:

		<p>Restriction Site Mapping</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.2	<p>Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.3	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.5.ES.	Environmental Science: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.5.ES.2	<p>Explain why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.5.ES.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.10.PS.	Physical Science: Nature of Science: Students shall design and safely conduct a scientific inquiry to solve valid problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.10.PS.2	<p>Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.13.PS.	Physical Science: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.PS.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.PS.5	<p>Describe in detail the methods used by scientists in their research</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.2.P.	Physics: Motion and Forces: Students shall understand two-dimensional motion.
STANDARD/STUDENT LEARNING EXPECTATION	MF.2.P.5	<p>Solve two-dimensional problems using the Pythagorean Theorem or the quadratic formula</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STRAND/CONTENT STANDARD	AR.17.P.	Physics: Nature of Science: Students shall safely design and conduct a scientific inquiry to solve valid problems.

STANDARD/STUDENT LEARNING EXPECTATION	NS.17.P.2	<p>Research and apply appropriate safety precautions (ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.20.P.	Physics: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.20.P.5	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression

Grade 10

STRAND/CONTENT STANDARD	AR.2.AP.	Anatomy and Physiology: Cellular Chemistry: Students shall understand the role of chemistry in body processes.
STANDARD/STUDENT LEARNING EXPECTATION	CC.2.AP.9	<p>Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	CC.2.AP.10	<p>Describe the characteristics and importance of enzymes</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.3.AP.	Anatomy and Physiology: Anatomy and Physiology of the Cell: Students shall understand that cells are the basic, structural, and functional units of life.
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.1	<p>Explain the structure and function of the plasma membrane</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.2	<p>Compare and contrast the different ways in which substances cross the plasma membrane: diffusion and osmosis, facilitated diffusion, active transport, filtration, endocytosis, exocytosis</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.3	<p>Describe the structure and function of organelles and cell parts</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II -

		<p>Gene Expression</p> <ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.4	<p>Identify chemical substances produced by cells</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Teacher Resource CD: Biotechnology Techniques II - Gene Expression Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.5	<p>Differentiate among replication, transcription, and translation</p> <ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	APC.3.AP.6	<p>Differentiate between mitosis and meiosis</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.17.AP.	Anatomy and Physiology: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.2	<p>Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression

STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.4	<p>Gather and analyze data using appropriate summary statistics</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.5	<p>Formulate valid conclusions without bias</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.AP.6	<p>Communicate experimental results using appropriate reports, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1:

		<p>Turning Genes On and Off</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.18.AP.	Anatomy and Physiology: Nature of Science: Students shall demonstrate an understanding of current life science theories.
STANDARD/STUDENT LEARNING EXPECTATION	NS.18.AP.2	<p>Relate the development of the cell theory to current trends in cellular biology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.18.AP.4	<p>Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome therapy)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.19.AP.	Anatomy and Physiology: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.19.AP.1	<p>Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.19.AP.2	<p>Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
STANDARD/STUDENT LEARNING EXPECTATION	NS.19.AP.3	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.20.AP.	Anatomy and Physiology: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.20.AP.2	<p>Discuss why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression

STANDARD/STUDENT LEARNING EXPECTATION	NS.20.AP.3	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.1.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of the role of chemistry in life processes.
STANDARD/STUDENT LEARNING EXPECTATION	MC.1.B.1	<p>Describe the structure and function of the major organic molecules found in living systems: carbohydrates, proteins, enzymes, lipids, nucleic acids</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.1.B.2	<p>Describe the relationship between an enzyme and its substrate molecule(s)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.2.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of the structure and function of cells.
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.2	Compare and contrast prokaryotes and eukaryotes

		<ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.3	<p>Describe the role of sub-cellular structures in the life of a cell: organelles, ribosomes, cytoskeleton</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression Teacher Resource CD: Biotechnology Techniques II - Gene Expression Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.4	<p>Relate the function of the plasma (cell) membrane to its structure</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression Teacher Resource CD: Biotechnology Techniques II - Gene Expression Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.5	<p>Compare and contrast the structures of an animal cell to a plant cell</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression Teacher Resource CD: Biotechnology Techniques II - Gene Expression Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	MC.2.B.10	<p>Analyze the meiotic maintenance of a constant chromosome number from one generation to the next</p>

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.3.B.	Biology: Molecules and Cells: Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
STANDARD/STUDENT LEARNING EXPECTATION	MC.3.B.1	<p>Compare and contrast the structure and function of mitochondria and chloroplasts</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.4.B.	Biology: Heredity and Evolution: Students shall demonstrate an understanding of heredity.
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.1	<p>Summarize the outcomes of Gregor Mendel's experimental procedures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.2	<p>Differentiate among the laws and principles of inheritance: dominance, segregation, independent assortment</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.4.B.4	<p>Examine different modes of inheritance: sex linkage, codominance, crossing over, incomplete dominance, multiple alleles</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.5.B.	Biology: Heredity and Evolution: Students shall investigate the molecular basis of genetics.
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.1	<p>Model the components of a DNA nucleotide and an RNA nucleotide</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.2	<p>Describe the Watson-Crick double helix model of DNA, using the base-pairing rule (adenine-thymine, cytosine-guanine)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2:

		<p>Sorting DNA Using Gel Electrophoresis</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.3	<p>Compare and contrast the structure and function of DNA and RNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	HE.5.B.4	<p>Describe and model the processes of replication, transcription, and translation</p>

		<ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.7.B.	Biology: Classification and the Diversity of Life: Students shall demonstrate an understanding that organisms are diverse.
STANDARD/STUDENT LEARNING EXPECTATION	CDL.7.B.9	<p>Classify bacteria according to their characteristics and adaptations</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	CDL.7.B.10	<p>Evaluate the medical and economic importance of bacteria</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STRAND/CONTENT STANDARD	AR.9.B.	Biology: Ecology and Behavioral Relationships: Students shall demonstrate an understanding of the ecological impact of global issues.
STANDARD/STUDENT LEARNING EXPECTATION	EBR.9.B.3	<p>Assess current world issues applying scientific themes (e.g., global changes in climate, epidemics, pandemics, ozone depletion, UV radiation, natural resources, use of technology, and public policy)</p> <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.11.B.	Biology: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.1	<p>Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes

STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.2	<p>Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.4	<p>Gather and analyze data using appropriate summary statistics</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.5	<p>Formulate valid conclusions without bias</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.11.B.6	<p>Communicate experimental results using appropriate reports, figures, and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.12.B.	Biology: Nature of Science: Students shall demonstrate an understanding of current life science theories.
STANDARD/STUDENT LEARNING EXPECTATION	NS.12.B.4	<p>Relate the development of the cell theory to current trends in cellular biology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.12.B.6	Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project-HGP, chromosome

		therapy) <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.13.B.	Biology: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.1	Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.2	Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware) <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.B.3	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.14.B.	Biology: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.14.B.2	<p>Discuss why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.14.B.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2:

		<p>Extracting Cellular DNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.9.C.	Chemistry: Bonding: Students shall understand the process of covalent bonding.
STANDARD/STUDENT LEARNING EXPECTATION	B.9.C.4	<p>Identify the strengths and effects of intermolecular forces (van der Waals): hydrogen bonding, dipole-dipole, dipole-induced dipole, dispersion forces (London)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication
STRAND/CONTENT STANDARD	AR.22.C.	Chemistry: Acids and Bases: Students shall demonstrate an understanding of titration as a laboratory tool.
STANDARD/STUDENT LEARNING EXPECTATION	AB.22.C.3	<p>Investigate the role of buffers</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
STRAND/CONTENT STANDARD	AR.29.C.	Chemistry: Organic Chemistry: Students shall demonstrate an understanding of the role of organic compounds in living and non-living systems.
STANDARD/STUDENT LEARNING EXPECTATION	OC.29.C.1	<p>Differentiate among the biochemical functions of proteins, carbohydrates, lipids, and nucleic acids</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
STANDARD/STUDENT LEARNING EXPECTATION	OC.29.C.2	Describe the manufacture of polymers derived from organic compounds: polymerization, crosslinking

		<ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication
STRAND/CONTENT STANDARD	AR.33.C.	Chemistry: Nature of Science: Students shall design and safely conduct scientific inquiry.
STANDARD/STUDENT LEARNING EXPECTATION	NS.33.C.2	<p>Research and apply appropriate safety precautions (refer to Arkansas Safety Lab Guide) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.36.C.	Chemistry: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.36.C.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1:

		<p>Discover How Plasmids Transfer Genes</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.1.ES.	Environmental Science: Physical Dynamics: Students shall understand the physical dynamics of Earth
STANDARD/STUDENT LEARNING EXPECTATION	PD.1.ES.11	<p>Describe the physical and chemical properties of water</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments
STRAND/CONTENT STANDARD	AR.3.ES.	Environmental Science: Social Perspectives: Students shall understand the impact of human activities on the environment.
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.9	<p>Evaluate personal and societal benefits when examining health, population, resource, and environmental issues</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.10	<p>Predict the long-term societal impact of specific health, population, resource, and environmental issues</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	SP.3.ES.11	<p>Investigate the effect of public policy decisions on health, population, resource, and environmental issues</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STRAND/CONTENT STANDARD	AR.4.ES.	Environmental Science: Nature of Science: Students shall use mathematics, science equipment, and technology as tools to communicate and solve environmental science problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.1	<p>Collect and analyze scientific data using appropriate mathematical calculations, figures and tables</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.2	<p>Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis
STANDARD/STUDENT LEARNING EXPECTATION	NS.4.ES.3	<p>Utilize technology to communicate research findings</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1:

		<p>Turning Genes On and Off</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.5.ES.	Environmental Science: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.5.ES.2	<p>Explain why scientists should work within ethical parameters</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.5.ES.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.13.PS.	Physical Science: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.PS.4	<p>Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1:

		<p>Engineering Recombinant DNA Molecules</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STANDARD/STUDENT LEARNING EXPECTATION	NS.13.PS.5	<p>Describe in detail the methods used by scientists in their research</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
STRAND/CONTENT STANDARD	AR.2.P.	Physics: Motion and Forces: Students shall understand two-dimensional motion.
STANDARD/STUDENT LEARNING EXPECTATION	MF.2.P.5	<p>Solve two-dimensional problems using the Pythagorean Theorem or the quadratic formula</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes
STRAND/CONTENT STANDARD	AR.17.P.	Physics: Nature of Science: Students shall safely design and conduct a scientific inquiry to solve valid problems.
STANDARD/STUDENT LEARNING EXPECTATION	NS.17.P.2	<p>Research and apply appropriate safety precautions (ADE Guidelines) when designing and/or conducting scientific investigations</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
STRAND/CONTENT STANDARD	AR.20.P.	Physics: Nature of Science: Students shall describe the connections between pure and applied science.
STANDARD/STUDENT LEARNING EXPECTATION	NS.20.P.5	Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology

		<ul style="list-style-type: none">• Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA• Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands• Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis• Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge• Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments• Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping• Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules• Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off• Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes• Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
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