

**Course Title: Introduction to Biotechnology**

<b>Unit:1</b>	Career Opportunities
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Trace the history of biotechnology.             <ol style="list-style-type: none"> <li>a. Identifying the scientific fields of relevant biotechnology</li> <li>b. Describing both scientific and non-scientific careers, roles and responsibilities of individuals working in biotechnology.</li> </ol> </li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Define biotechnology</li> <li>2. Explore the historical stages of biotechnology.</li> <li>3. Discuss the historical impact of genetics on society.</li> <li>4. Make connections between the various scientific fields and their application to biotechnology.</li> <li>5. Provide examples of the various science and non-science careers associated with biotechnology.</li> <li>6. Explore the various roles and responsibilities of individuals working in biotechnology through hands-on lab experiences, speakers, and experience or research on a day in the life of a biotechnology professional.</li> </ol>
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<b>Essential Question(s):</b>	What are the scientific fields, career roles and responsibilities needed by individuals working in the biotechnology field? What are the benefits of technology in health, food supply, materials and environment?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<ol style="list-style-type: none"> <li>I. History of Biotechnology               <ol style="list-style-type: none"> <li>A. Meaning and History                   <ol style="list-style-type: none"> <li>1. What is biotechnology?</li> <li>2. Major areas/stages</li> <li>3. Developmental Timelines</li> <li>4. Impact on medicine, agriculture and environment</li> </ol> </li> <li>B. Careers in biotechnology                   <ol style="list-style-type: none"> <li>1. Biochemist</li> <li>2. Plant Biotechnologist</li> <li>3. Pharmacist</li> <li>4. Research Veterinarian</li> </ol> </li> </ol> </li> </ol>	<p>Research:</p> <ul style="list-style-type: none"> <li>-Periods in the history of biotechnology</li> <li>-Scientific fields associated with biotechnology</li> <li>-Careers related to the field of biotechnology</li> </ul> <p>Presentations:</p> <ul style="list-style-type: none"> <li>-Biotechnology timeline</li> <li>-Field &amp; career synopsis</li> </ul> <p>Demonstrations:</p> <ul style="list-style-type: none"> <li>-Provide posters, pictures or actual products related to biotechnology</li> </ul>	<p>Internet:</p> <p>HudsonAlpha</p> <ul style="list-style-type: none"> <li>- <a href="http://www.hudsonalpha.org">www.hudsonalpha.org</a> (career links)</li> </ul> <p>Biotech Association of Alabama</p> <ul style="list-style-type: none"> <li>- <a href="http://www.bioalabama.com">www.bioalabama.com</a> (provides web-links to Alabama biotech companies)</li> </ul> <p>Textbooks:</p> <ul style="list-style-type: none"> <li>- <u>Biotechnology: Science for the New Millennium</u> Ellyn Daugherty</li> </ul>

<p>5. Biomedical Researcher</p> <p>C. Benefits of Biotechnology</p> <ol style="list-style-type: none"> <li>1. Improved Food Supplies</li> <li>2. Better Shelter</li> <li>3. Improved Health Care</li> <li>4. Protection of environment</li> </ol>	<p>Interview:</p> <ul style="list-style-type: none"> <li>-Community members involved in biotechnology</li> </ul> <p>HOSA Biomedical Debate</p> <ul style="list-style-type: none"> <li>-Introduce HOSA theme</li> <li>-Introduce guidelines for debate</li> <li>-Mock debate activity on excerpts from Genome on eugenics and ethics as it applies to advances in modern biotechnology</li> </ul>	<p>Guest Speakers:</p> <ul style="list-style-type: none"> <li>- Biotech Association of Alabama (CEOs, CSOs, scientists, technicians, etc.)</li> <li>- Hospital technicians, etc.</li> <li>- Doctors in various fields who work with biotechnology</li> </ul> <p>Additional resource books</p> <p>Genome – Matt Ridley (excellent excerpts on the eugenics movement and topics related to each chromosome in the human body)</p>
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<p><b>Unit Assessment:</b></p>	<p>Biotechnology timeline; Field &amp; career presentations; Interview paper; debate; test or quiz</p>
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<p><b>Unit/Course CTSO Activity:</b></p>	<p>Plan a career day for Winter and begin to invite local companies and scientists</p>
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<p><b>Unit/Course Culminating Product:</b></p>	
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<p><b>Course/Program Credential(s):</b>   <input type="checkbox"/> Credential   <input type="checkbox"/> Certificate   <input type="checkbox"/> Postsecondary Degree   <input type="checkbox"/> University Degree</p> <p><input type="checkbox"/> Other:</p>
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**Course Title: Introduction to Biotechnology**

<b>Unit:2</b>	Safety
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <p>2. Exhibit appropriate safety procedures in the laboratory.</p> <p>Examples: demonstrating proper use of personal protection devices, maintaining a sanitary laboratory environment, handling biological and chemical hazards properly, following laboratory protocols, maintaining proper documentation, labeling, and record keeping.</p>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Demonstrate appropriate safety procedures in the laboratory.</li> <li>2. Demonstrate proper use of personal protection devices.</li> <li>3. Learn to maintain a sanitary laboratory environment and handle biological and chemical hazards properly.</li> <li>4. Follow laboratory protocols and maintain proper documentation, labeling, and record keeping.</li> <li>5. Explain and apply the process of the scientific method</li> </ol>
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<b>Essential Question(s):</b>	What is the meaning of safety as it relates to biotechnology?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
<p>I. Safety</p> <p>A. Common Hazards</p> <ol style="list-style-type: none"> <li>1. Eyes</li> <li>2. Skin and Hands</li> <li>3. Hearing</li> </ol> <p>B. Personal Protective Equipment</p> <p>C. Environmental Safety</p> <p>D. U. S. Guidelines</p>	<p>Experiments:</p> <p>Setting up a legal scientific notebook</p> <p>Lab safety rules</p> <p>Tour of lab</p> <p>Cheese making</p> <p>HOSA Biomedical debate practice: Safety</p>	<p>Textbook</p> <ul style="list-style-type: none"> <li>- <u>Biotechnology Laboratory Manual</u> Ellyn Daugherty</li> <li>- <u>Biotechnology: Science for the New Millennium</u> Ellyn Daugherty</li> </ul> <p>Speaker</p> <p>Safety Officer</p>

<b>Unit Assessment:</b>	Lab safety test, Lab notebook check, Cheese making lab report
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**Unit/Course  
CTSO Activity:**

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**Unit/Course  
Culminating  
Product:**

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**Course/Program Credential(s):**  Credential  Certificate  Postsecondary Degree  University Degree  
 Other:

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**Course Title: Introduction to Biotechnology**

<b>Unit:3</b>	Biochemistry Concepts
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>3. Explain concepts important to solution preparation.             <ol style="list-style-type: none"> <li>a. Explain the concepts of molecular mass, mole, and formula weight</li> <li>b. Calculating molecular mass of specific molecules and the molarity of a solution</li> <li>c. Preparing solutions of defined concentration Examples: Preparing serial dilutions of specific solutions</li> <li>d. Adjusting the pH of specific solutions with commonly used acids and bases</li> </ol> </li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Define solution</li> <li>2. Explain the concepts of molecular mass, mole, formula weight, molarity, concentration and pH</li> <li>3. Calculate the mass of specific molecules and the molarity of a solution</li> <li>4. Measure solids accurately utilizing balances</li> <li>5. Measure small liquid volumes utilizing the appropriate measuring device including graduated cylinders, pipettes, micropipettes</li> <li>6. Prepare solutions of defined concentration</li> <li>7. Understand and be able to calculate a specified dilution</li> <li>8. Prepare a specific dilution of a given concentrated solution</li> <li>9. Properly balance and run a microcentrifuge</li> <li>10. Define pH and explain the correlation between pH and the OH<sup>-</sup> and H<sup>+</sup> concentrations</li> <li>11. Learn the appropriate uses of a pH meter and demonstrate proficiency by preparing a solution of a designed pH</li> </ol>
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<b>Essential Question(s):</b>	What responsibilities and basic skills are involved with biotechnology careers?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
Biochemistry Concepts A. Chemical concepts relevant to Biotechnology B. Characteristics of bio-molecules C. Molarity D. pH solution preparation	Demonstrations Proper use of balances, pH meter & micropipettes Experiments Measuring Small Volumes Measuring Mass	Textbooks - <u>Biotechnology Laboratory Manual</u> Ellyn Daugherty - <u>Biotechnology: Science for the New Millennium</u> Ellyn Daugherty

	Making Solutions Making Dilutions Using a spectrophotometer Measuring and adjusting the pH of Solutions	
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<b>Unit Assessment:</b>	Practice calculations, lab/skill performance, lab notebook check, test
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<b>Unit/Course CTSO Activity:</b>	HOSA Biomedical Debate practice
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<b>Unit/Course Culminating Product:</b>	Job shadowing with a biotechnologist and report (written and verbal).
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<b>Course/Program Credential(s):</b> <input checked="" type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:

**Course Title: Introduction to Biotechnology**

<b>Unit:4</b>	Genetics and Cell Biology Concepts (4-5)
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>4. Correlate key cellular components to function. Examples: nucleus, chromosome, ribosome, mitochondria</li> <li>5. Describe the process of meiosis and the cell cycle, including the hereditary significance of each.             <ol style="list-style-type: none"> <li>a. Comparing typical and atypical chromosome karyotypes</li> <li>b. Comparing spermatogenesis and oogenesis using charts</li> </ol> </li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Correlate key cellular components to their function.</li> <li>2. Describe the role of mitotic divisions during growth and repair</li> <li>3. Explore stem cells and their potential applications</li> <li>4. Explore the role of the cell cycle</li> <li>5. Explore the role of the cell cycle as the underlying cause of cancer</li> <li>6. Describe the role of meiotic divisions in reproduction</li> <li>7. Understand how meiotic errors result</li> <li>8. Understand the relationship between meiotic errors resulting in polyploid, aneuploidy and euploidy and atypical phenotypes</li> <li>9. Explore karyotyping and investigate modern methods of karyotyping</li> <li>10. Become familiar with prenatal diagnostics</li> <li>11. Discuss the ethical implications of prenatal testing</li> <li>12. Compare and contrast spermatogenesis and oogenesis</li> </ol>
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<b>Essential Question(s):</b>	<p>What are the key roles of the components of a cell? What is the purpose of meiosis? What are the causes of atypical karyotypes? What is cytogenetics? What is genetic counseling?</p>
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
<ol style="list-style-type: none"> <li>I. Functions of cell components               <ol style="list-style-type: none"> <li>A. Cell cycle and meiosis                   <ol style="list-style-type: none"> <li>1. Typical and atypical chromosome karyotypes</li> </ol> </li> </ol> </li> </ol>	<p>Group investigation</p> <ul style="list-style-type: none"> <li>-NIH cancer module</li> <li>-GSLC stem cell activity</li> </ul>	<p>Textbook</p> <p><u>-Biotechnology: Science for a New Millennium</u> Ellyn Daugherty</p>

<p>2. Spermatogenesis and oogenesis</p>	<p>Oral presentation -Disorders or prenatal testing -Stem cell debate</p> <p>Experimental Activities -HeLa Splat Lab -HAIB: Disorder Detectives</p> <p>Note taking -Cell Cycle and Mitosis foldable -KWL</p>	<p>Lab supplies and equipment - HAIB: Disorder Detectives - HeLa Splat Lab</p> <p>Laptop and LDC projector</p> <p>Web Sites -The Biology Project: <a href="http://www.biology.arizona.edu">http://www.biology.arizona.edu</a></p> <p>-NIH Cell Biology &amp; cancer module: <a href="http://science.education.nih.gov/supplements/nih1/cancer/default.htm">http://science.education.nih.gov/supplements/nih1/cancer/default.htm</a></p> <p>-Inside Cancer <a href="http://www.insidecancer.org">www.insidecancer.org</a></p> <p>-Your Genes, Your Health <a href="http://www.ygyh.org">www.ygyh.org</a></p> <p>-Genetics Science Learning Center teach.genetics.utah.edu learn.genetics.utah.edu</p>
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<p><b>Unit Assessment:</b></p>	<p>Lab Notebook Checks, Activities assessments, Presentations, test</p>
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<p><b>Unit/Course CTSO Activity:</b></p>	
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<p><b>Unit/Course Culminating Product:</b></p>	
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<p><b>Course/Program Credential(s):</b> X <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree  <input type="checkbox"/> Other:</p>
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**Course Title: Introduction to Biotechnology**

<b>Unit:4</b>	Genetics and Cell Biology Concepts (6-8)
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>6. Describe the significance of Mendel’s work to the development of the modern science of genetics, including the laws of segregation and independent assortment.</li> <li>7. Describe the inheritance patterns based on gene interactions.             <ol style="list-style-type: none"> <li>a. Predicting patterns of heredity using pedigree analysis</li> <li>b. Identifying incomplete dominance, co-dominance, multiple allelism</li> </ol> </li> <li>8. Describe occurrences and effects of sex linkage, autosomal linkage, crossover, multiple alleles, and polygenes.</li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>1. Conduct monohybrid and dihybrid crosses</li> <li>2. Understand the laws of segregation and independent assortment</li> <li>3. Learn the genetic and molecular basis of inherited disorders and the patterns in which they are inherited.</li> <li>4. Construct an accurate pedigree across multiple generations</li> <li>5. Predict patterns of heredity using pedigree analysis</li> <li>6. Understand the connection between genetic counseling, pedigrees and genetic testing</li> <li>7. Understand the inheritance patterns of incomplete dominance, co-dominance, multiple allelism and provide examples of each</li> <li>8. Identify occurrences and effects of sex linkage, autosomal linkage, crossover, multiple alleles, and polygenes.</li> </ol>
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<b>Essential Question(s):</b>	What are two variations of mendelian inheritance?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
II. Gene Transmission: Modification of Mendelian Genetics B. Inheritance 1. Pedigree analysis	Research HOSA biomedical debate yearly topic Disorders	Textbooks <u>-Biotechnology Laboratory Manual</u> Ellyn Daugherty <u>-Biotechnology: Science for the New Millennium</u> Ellyn Daugherty

<p>2. Incomplete dominance, Co-dominance, allelism</p> <p>C. Occurrences and effects</p> <ol style="list-style-type: none"> <li>1. Sex linkage</li> <li>2. Autosomal linkage</li> <li>3. Crossover</li> <li>4. Multiple alleles</li> <li>5. polygenes</li> </ol>	<p>Activities</p> <ul style="list-style-type: none"> <li>-Practice problem sets</li> </ul> <p>Experimental Activities</p> <ul style="list-style-type: none"> <li>-HAIB: HNPCC Lab</li> <li>-Fingerprinting Lab</li> <li>-Blood Typing Investigation</li> </ul> <p>HNPCC extension: HOSA debate – genetic testing</p>	<p>Web Sites</p> <p>HAIB: HNPCC website <a href="http://education.hudsonalpha.org/Kits/Cancer.html">http://education.hudsonalpha.org/Kits/Cancer.html</a></p> <p>Genetic Science Learning Center</p> <ul style="list-style-type: none"> <li>-Learn.genetics.utah.edu</li> <li>-Teach.genetics.utah.edu</li> </ul>
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<p><b>Unit Assessment:</b></p>	<p>Laboratory Notebook Check, Lab reports, research projects, practice problems, test</p>
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<p><b>Unit/Course CTSO Activity:</b></p>	
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<p><b>Unit/Course Culminating Product:</b></p>	
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<p><b>Course/Program Credential(s):</b>   <input type="checkbox"/> Credential   <input type="checkbox"/> Certificate   <input type="checkbox"/> Postsecondary Degree   <input type="checkbox"/> University Degree</p> <p><input type="checkbox"/> Other:</p>
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**Course Title: Introduction to Biotechnology**

<b>Unit:4</b>	Genetics and Cell Biology Concepts (9-10)
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>9. Describe the structure and function of deoxyribonucleic acid (DNA), including replication, translation, and transcription.</p> <ol style="list-style-type: none"> <li>a. Applying the genetic code to predict amino acid sequence</li> <li>b. Describing methods cells use to regulate gene expression</li> <li>c. Defining the role of ribonucleic acid (RNA) in protein synthesis</li> <li>d. Performing DNA extraction and separation techniques</li> <li>e. Analyzing DNA previously amplified using polymerase chain reaction</li> </ol> <p>10. Explain the structure of eukaryotic chromosomes, including transposons, introns, and exons.</p>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<ol style="list-style-type: none"> <li>1. Identify the structure and function of DNA and RNA</li> <li>2. Explain the structure of eukaryotic chromosomes, including transposons, introns, and exons</li> <li>3. Describe the mechanism for DNA replication</li> <li>4. Understand the process of the Polymerase Chain Reaction (PCR)</li> <li>5. Identify applications of PCR in biotechnology</li> <li>6. Apply the genetic code to predict amino acid sequence</li> <li>7. Define the role of RNA in protein synthesis</li> <li>8. Describe the mechanisms for transcription and translation</li> <li>9. Describe the methods cells use to regulate gene expression</li> <li>10. Explain the levels of protein structure and the correlation to protein function</li> <li>11. Explain the types of proteins and their roles</li> </ol>
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<b>Essential Question(s):</b>	What is the chemical composition and structure of DNA and RNA? What is the Central Dogma? What mechanisms are involved in transcription and translation? How are genes regulated?
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Content Knowledge	Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)	Suggested Materials, Equipment and Technology Resources
<p>I. Structure and function of DNA</p> <p style="padding-left: 20px;">A. Structure of eukaryotic Chromosomes</p>	<p>Reading, worksheets, instructional technology, note taking</p>	<p>Textbooks</p> <p><u>-Biotechnology Laboratory Manual</u></p> <p>Ellyn Daugherty (ch. 4 &amp; 5)</p>

<p>B. Mechanisms of the Central Dogma</p> <p>II. Applications to Biotechnology</p> <p>A. PCR</p>	<p>Worksheets</p> <ul style="list-style-type: none"> <li>-DNA origami (DNAi activity)</li> <li>-Draw the structure of a chromosome</li> <li>-Calculate PCR products</li> <li>-Color a diagram of transcription &amp; translation</li> <li>-Transcription &amp; translation practice activities</li> <li>-Protein structure activity</li> </ul> <p>Experimental Activities</p> <ul style="list-style-type: none"> <li>-Expanded DNA extraction</li> <li>-Testing for the Presence of DNA, RNA and Protein in DNA extracts</li> <li>-Making Agarose Gels</li> <li>-Gel Electrophoresis/DNA analysis</li> <li>-Human DNA extraction</li> <li>-Alu PCR genotyping</li> <li>-Antibody Function</li> <li>-Enzyme Function</li> <li>-PAGE</li> <li>-Protein Identification</li> </ul>	<p><u>-Biotechnology: Science for the New Millennium</u> Elynn Daugherty</p> <p>Web Sites</p> <p>Dolan DNA Learning Center (with links to)</p> <ul style="list-style-type: none"> <li>- <a href="http://www.dnalc.org">www.dnalc.org</a></li> <li>- <a href="http://www.dnai.org">www.dnai.org</a> (DNA interactive)</li> </ul> <p>Genetic Science Learning Center</p> <ul style="list-style-type: none"> <li>-Teach.genetics.utah.edu</li> <li>-Learn.genetics.utah.edu</li> </ul>
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<p><b>Unit Assessment:</b></p>	<p>Laboratory notebook checks, skill checks, practice problems, test</p>
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<p><b>Unit/Course CTSO Activity:</b></p>	<p>Biomedical debate Research and Development Project based Presentation and report.</p>
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<p><b>Unit/Course Culminating Product:</b></p>	<p>Internship with biomedical technologist Work-based project</p>
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<p><b>Course/Program Credential(s):</b> <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:</p>
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**Course Title: Introduction to Biotechnology**

<b>Unit:4</b>	Genetics and Cell Biology Concepts (11-12)
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	<p>Students will:</p> <ol style="list-style-type: none"> <li>11. Describe factors such as radiation, chemicals, and chance that cause mutations.             <ol style="list-style-type: none"> <li>a. Describing the effects of genetic variability on adaptations</li> <li>b. Describing how DNA mutations impact both the organism and population</li> </ol> </li> <li>12. Explain how the Hardy-Weinberg Principle provides a baseline for recognizing evolutionary changes in gene frequency due to genetic drift, gene flow, non-random mating, mutation, and natural selection.</li> </ol>
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<ol style="list-style-type: none"> <li>1. Describe the factors such as radiation, chemicals, and chance that cause mutations.</li> <li>2. Describe the effects of genetic variability on adaptations.</li> <li>3. Describe how DNA mutations impact both the organism and population.</li> <li>4. Explain how the Hardy-Weinberg Principle provides a baseline for recognizing evolutionary changes in gene frequency due to genetic drift, gene flow, nonrandom mating, mutation and natural selection</li> <li>5. Define the variables associated with the Hardy-Weinberg association.</li> </ol>
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<b>Essential Question(s):</b>	What are mutations? What factors contribute to the diversity of a population? What is the Hardy-Weinberg Principle?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
Mutations Hardy – Weinberg Principle	Bacterial mutation lab Hardy – Weinberg activity	<u>Survival of the Sickest</u> Dr. Sharon Moalem

<b>Unit Assessment:</b>	
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<b>Unit/Course CTSO Activity:</b>	
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**Unit/Course  
Culminating  
Product:**

**Course/Program Credential(s):**  Credential  Certificate  Postsecondary Degree  University Degree

Other:

**Course Title: Introduction to Biotechnology**

**Unit:4** Genetics and Cell Biology Concepts (13-14)

**Content Standard(s) and Depth of Knowledge Level(s):**

Students will:

13. Differentiate among major areas in modern biotechnology, including plant, animal, microbial, forensic, and marine.

Examples: hybridization, cloning, insulin production, DNA profiling, bioremediation

- a. Describing techniques used with recombinant DNA
- b. Demonstrating proper maintenance of bacterial cultures, including preparing a growth media and culturing microorganisms
- c. Demonstrating recombinant DNA techniques in bacteria, including performing a plasmid transformation and a restriction digest

14. Explain the development, purpose, findings, and applications of the Human Genome Project.

- a. Analyzing results of the Human Genome Project to predict ethical, social, and legal implications
- b. Describing medical uses of gene therapy, including vaccines, and tissue and antibody engineering
- c. Using computer bioinformatics resources to provide information regarding DNA, protein, and human genetic diseases

Examples: National Center for Biotechnology Information, protein data bank, genereviews

**Learning Objective(s) and Depth of Knowledge Level(s):**

1. Define genetic recombination
2. Define the role of bacterial structures and bacterial reproduction
3. Explore the role of bacteria in biotechnology today
4. Prepare and maintain bacterial cultures
5. Demonstrate genetic recombinant DNA techniques including restriction digest and transformation
6. Define the meaning of genetically modified organisms
7. Explore how and why genetically modified foods are created
8. Discuss ethical issues raised by recombinant DNA technology
9. Explore the commercial and medical applications of biotechnology
10. Describe methods of cloning and conduct techniques for clone characterization
11. Explain the principle and purpose of vaccination
12. Explain the mechanism of antibody formation including the genetic recombination involved in generating distinctive antibodies
13. Discuss tissue and antibody engineering and their applications
14. Discuss gene therapy
15. Explain the development, purpose, findings, and applications of the Hume Genome Project.
16. Analyzing results of the Human Genome Project to predict ethical, social, and legal implications



	<p>17. Access and utilize genetic libraries</p> <p>18. Discuss the field of bioinformatics</p> <p>19. Utilize active databanks such as NCBI to obtain information</p>
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<b>Essential Question(s):</b>	What is the Human Genome Project? What are the current and future applications of the data generated from the Human Genome Project? Where is biotechnology headed now?
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
<p>I. Major areas of Biotechnology</p> <p>A. plant</p> <p>B. animal</p> <p>C. microbial</p> <p>D. forensic</p> <p>E. marine</p> <p>II. Human Genome Project</p>	<p>Lecture</p> <p>Activity</p> <p>-Plasmid Recombination (paper activity)</p> <p>Laboratory Experiments</p> <p>-Making Media for Bacterial Cell Culture</p> <p>-Aseptic Technique and Pouring Plates</p> <p>-Growing Bacteria in Cell Culture</p> <p>-Transformation</p> <p>-Restriction Analysis of plasmid</p> <p>-Miniprep of a plasmid</p> <p>-HAIB: Bioinformatics Lab</p> <p>-HAIB: ELISA</p> <p>Research project</p> <p>-Xenotransplantation, gene therapy, tissue and antibody engineering</p>	<p>Textbooks</p> <p>-<u>Biotechnology Laboratory Manual</u></p> <p>Ellyn Daugherty</p> <p>-<u>Biotechnology: Science for the New Millennium</u></p> <p>Ellyn Daugherty</p> <p>Web Sites</p> <p>National Center for Biotechnology Information</p> <p><a href="http://www.ncbi.nlm.nih.gov">www.ncbi.nlm.nih.gov</a></p> <p>Genetics Science Learning Center:</p> <p>-learn.genetics.utah.edu</p> <p>-teach.genetics.utah.edu</p> <p>Dolan DNA Learning Center</p> <p>- <a href="http://www.dnalc.org">www.dnalc.org</a> with links to:</p> <p>Your Genes, Your Health</p> <p>- <a href="http://www.ygyh.org">www.ygyh.org</a></p> <p>DNA interactive</p> <p>- <a href="http://www.dnai.org">www.dnai.org</a></p> <p>HudsonAlpha Institute for Biotechnology</p> <p>- <a href="http://www.hudsonalpha.org">www.hudsonalpha.org</a></p>

		<p>ELISA lab website  - <a href="http://education.hudsonalpha.org/Kits/ELISA.html">http://education.hudsonalpha.org/Kits/ELISA.html</a></p> <p>Bioinformatics lab website  <a href="http://education.hudsonalpha.org/Kits/Bioinformatics.html">http://education.hudsonalpha.org/Kits/Bioinformatics.html</a></p> <p>Detecting Genetically Modified Foods Lab  - <a href="http://education.hudsonalpha.org/Kits/GMOD.html">http://education.hudsonalpha.org/Kits/GMOD.html</a></p> <p>Reference Book  <u>Genome</u> – Matt Ridley</p>
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<b>Unit Assessment:</b>	Lab tests, Lab notebook, skill checks, research paper and presentation, test
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<b>Unit/Course CTSO Activity:</b>	Biomedical Debate Researched persuasive speech
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<b>Unit/Course Culminating Product:</b>	Internship with a Biotechnologist
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<b>Course/Program Credential(s):</b> X <input type="checkbox"/> Credential <input type="checkbox"/> Certificate <input type="checkbox"/> Postsecondary Degree <input type="checkbox"/> University Degree <input type="checkbox"/> Other:
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**Course Title: Introduction to Biotechnology**

<b>Unit:4</b>	Genetics and Cell Biology Concepts (15)
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<b>Content Standard(s) and Depth of Knowledge Level(s):</b>	15. Describe the replication of DNA and RNA viruses, including lytic and lysogenic cycles, using diagrams.
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<b>Learning Objective(s) and Depth of Knowledge Level(s):</b>	<ol style="list-style-type: none"> <li>1. Describe the replication of DNA viruses</li> <li>2. Describe the replication of RNA (retroviruses)</li> <li>3. Compare and contrast the mutation rates between a DNA virus and an RNA virus</li> <li>4. Describe the linkage between the RNA viral replication mechanism and its mutation rate</li> <li>5. Diagram a lifecycle of a lytic virus</li> <li>6. Diagram a lifecycle of a lysogenic virus (Examples include: Epstein-Barr, Humanpapilloma virus HPV)</li> </ol>
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<b>Essential Question(s):</b>	
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<b>Content Knowledge</b>	<b>Suggested Instructional Activities Rigor &amp; Relevance Framework (Quadrant)</b>	<b>Suggested Materials, Equipment and Technology Resources</b>
1. Replication of DNA & RNA viruses and the medical significance of those mechanisms	Activity Diagram the lifecycle of both a lytic and lysogenic virus  Research DNA & RNA viruses Current vaccinations & vaccination research	Video Assignment Discovery: An inside look at the flu

<b>Unit Assessment:</b>	
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<b>Unit/Course CTSO Activity:</b>	
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**Unit/Course  
Culminating  
Product:**

**Course/Program Credential(s):**  Credential  Certificate  Postsecondary Degree  University Degree  
 Other: