GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Introduction to Biotechnology

UNIT 1: Overview of Biotechnology

INTRODUCTION

Annotation:

This unit introduces students to the world of biotechnology by giving a general overview, including an examination of the historical developments that lead to the development of biotechnology. Activities in this unit are included to provide opportunities for students to refresh on the scientific method as they begin thinking about biotechnology.

Grade(s):

X	9th
X	10th
X	11th
X	12th

Time:

8 hours

Author:

Phyllis Dumas

Students with Disabilities:

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

FOCUS STANDARDS

GPS Focus Standards:

HS-IBT-2 **Students will understand the basis for biotechnology products and how such products affect the quality of life.**

a) Describe the major scientific discoveries that lead to development of recombinant DNA technology, including those in the fields of biology, chemistry, genetics, and microbiology, and explain how these advances in DNA technology are used today

b) Identify past and current discoveries and developments in fields such as, agriculture, diagnostics, medical devices, pharmaceuticals, and research and development.

GPS Academic Standards:

SCSh1. **Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.**

a. Exhibit the above traits in their own scientific activities.

b. Recognize that different explanations often can be given for the same evidence.

c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh7. **Students analyze how scientific knowledge is developed.**

Students recognize that:

a. The universe is a vast single system in which the basic principles are the same everywhere.

b. Universal principles are discovered through observation and experimental verification.

c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.

d. Hypotheses often cause scientists to develop new experiments that produce additional data.

e. Testing, revising, and occasionally rejecting new and old theories never ends.

SB2 **Students will analyze how biological traits are passed on to successive generations.**

f) Examine the use of DNA technology in forensics, medicine, and agriculture.

ELA10RC2 **The student participates in discussions related to curricular learning in all subject areas. The student:**

c) Relates messages and themes from one subject area to those in another area.

UNDERSTANDINGS & GOALS

Enduring Understandings:

Modern biotechnology is a relatively young field of science that has its roots in many scientific developments related to DNA technology. Contributions have come from various fields such as biology, chemistry, genetics, and microbiology. A number of past and present discoveries and developments may

be found in areas such as agriculture, diagnostics, medical devices, industrial environmental, pharmaceuticals, and research and development.

Essential Questions:

- What is the function of biotechnology?
- How has modern biotechnology been impacted by scientific developments in DNA technology?
- How have developments in the fields of biology, chemistry, genetics and microbiology contributed to biotechnology?
- What past and present discoveries and developments have impacted areas such as agriculture, diagnostics, medical devices, pharmaceuticals, and research and development?

Knowledge from this Unit:

Students will be able to:

- Define biotechnology.
- Describe how biotechnology relates to the past, present and future.
- Identify biotechnology developments that have impacted various areas of life.
- Identify major contributions to the field of biotechnology.
- Explain the discovery of recombinant DNA.
- Recognize components of the scientific method

Skills from this Unit:

Students will be able to:

- Create a timeline of events related to biotechnology.
- Work together and develop teamwork skills.
- Demonstrate application of biotechnology in fermentation

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
_X_ Unit test
_X___ Group project
_____ Individual project
_____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests
_____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing

_____ Dialogue and Discussion
__ Student/teacher conferences
_x_ Partner and small group discussions
__ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
_____ Post-test

Assessment Attachments and / or Directions:

Rubric for Timeline

LESSON PLANS

• LESSON 1: INTRODUCTION TO BIOTECHNOLOGY

1. Identify the standards. Standards should be posted in the classroom.

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2. Review Essential Questions. Post Essential Questions in the classroom.

   - What is the function of biotechnology?
   - How has modern biotechnology been impacted by scientific developments in DNA technology?
   - How have developments in the fields of biology, chemistry, genetics and microbiology contributed to biotechnology?
   - What past and present discoveries and developments have impacted areas such as agriculture, diagnostics, medical devices, pharmaceuticals, and research and development?
   - What early methods are still in use today?

3. Identify and review the unit vocabulary. Terms may be posted on word wall.

Agricultural Biotechnology	Enzymes	Occupational Safety and Health Administration
Batch Processes	Fermentation	Pharmaceutical Biotechnology
Bioinformatics	Food and Drug Administration	Recombinant DNA technology
Biotechnology	Gene Cloning	Research and Development
CDC	Genome	Scientific Method
Diagnostic Biotechnology	Genetically Modified Foods	Selective Breeding
DNA	Human Genome Project	U.S. Department of Agriculture
Environmental and Aquatic Biotechnology	Industrial Biotechnology	Vaccines
Environmental Protection Agency	Medical Biotechnology	

4. Interest approach – Mental set
   - **Note:** Before teaching this lesson, set up six stations around the room, each with four items, pictures, or words related to marine, desert, bioterrorism, bioinformatics, agricultural, classic, patents, medical, industrial, and nutritional areas of biotechnology.
   - Break the class into six groups and give each group a copy of the **What's Going On?** handouts.
     - See attached supplementary files
   - Give the groups 15 minutes to complete the activity.
   - Ask each group's reporter to share their answers with the class.

• LESSON 2: MODERN BIOTECHNOLOGY

1. Review Essential Questions. Post Essential Questions in the classroom.

   - How has modern Biotechnology been impacted by scientific developments in DNA technology?

2. Lead a brief discussion about biotechnology.
   - Ask students, "What is biotechnology?"
   - How do you think biotechnology affects us?
   - What are some biotechnology products and events in the news?
   - Do you think biotechnology is important? Why or why not?

3. What is Biotechnology?
   - Show students the **Introduction to Biotechnology** PowerPoint presentation.
     - See attached supplementary files

4. Biotechnology Rainbow

- Show students the **Biotechnology Rainbow** PowerPoint presentation.
    - See attached supplementary files
- Allow students to work in small groups and assign each one an area of biotechnology from the **Biotechnology Rainbow Chart** handout.
    - See attached supplementary files
- Have students write a paragraph about how this area of biotechnology is affecting the world.

• LESSON 3: HISTORY OF BIOTECHNOLOGY

1. Review Essential Questions. Post Essential Questions in the classroom.

    - How have developments in the fields of biology, chemistry, genetics and microbiology contributed to biotechnology?
    - What past and present discoveries and developments have impacted areas such as agriculture, diagnostics, medical devices, pharmaceuticals, and research and development?

2. History of Biotechnology
    - Show students the **Biotechnology Through the Ages** PowerPoint presentation.
        - See attached supplementary files

3. Back to the Future Project
    - Split the class into small groups and assign each group one color from the **Biotechnology Rainbow Chart** given out in Lesson 2.
    - Give each group a copy of the **Back to the Future** handout.
        - See attached supplementary files
    - Have students work together to create a timeline, either as a poster or as a multimedia presentation, about their assigned biotechnology field.
    - After students have completed their projects, allow them to present their timelines to the rest of the class, and score the timelines and presentations using the **Back to the Future Rubric**.

• LESSON 4: APPLICATIONS OF BIOTECHNOLOGY

1. Review Essential Questions. Post Essential Questions in the classroom.

    - What early methods are still in use today?

2. Jeans or Genes?
    - **Note:** Before teaching this lesson, ask students to either wear or bring in a pair of faded or stone-washed jeans.
    - Access **www.europabio.org/documents/JEANS.pdf** and show students the document about stonewashed jeans and how they relate to biotechnology.

3. Uses of Yeast
    - Have students perform one of the yeast and balloon experiments found on **http://www.sciencebob.com/experiments/yeast.php** and **http://www.prairiepride.org/teachertools/staffpdf/sBender_Yeast%20Lab%20.pdf**.

4. Assessment
    - Have students complete the **Overview of Biotechnology Quiz**, which can be graded using the **Overview of Biotechnology Quiz Key**.

• ATTACHMENTS FOR LESSON PLANS

What's Going On?
Introduction to Biotechnology
Biotechnology Rainbow
Biotechnology Rainbow Chart
Biotechnology Through the Ages
Back to the Future
Back to the Future Rubric
Overview of Biotechnology Quiz
Overview of Biotechnology Quiz Key
Scientific Method
Biotechnology Glossary

• NOTES & REFLECTION:

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title:

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

Attachments for Culminating Performance Task:

UNIT RESOURCES

Web Resources:

www.europabio.org/documents/JEANS.pdf
http://www.sciencebob.com/experiments/yeast.php
http://www.prairiepride.org/teachertools/staffpdf/sBender_Yeast%20Lab%20.pdf.

Materials & Equipment:

- Colored paper
- Various biotechnology-related items
- Faded jeans sample
- Materials required for balloons and yeast experiment

21st Century Technology Used:

X	Slide Show Software		Graphing Software		Audio File(s)
	Interactive Whiteboard		Calculator		Graphic Organizer
	Student Response System		Desktop Publishing	X	Image File(s)
	Web Design Software		Blog		Video
	Animation Software		Wiki		Electronic Game or Puzzle Maker
	Email	X	Website		