GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Applications of Biotechnology

UNIT 3: Historical Experimental Events

INTRODUCTION

Annotation:

This unit includes lessons on how scientific knowledge evolved, a time line of historical experimental events in biotechnology, and the importance of testing and revising the experimental design.

Grade(s):

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

Time:

5 hours

Author:

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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-ABT-4 **Students will use inquiry to demonstrate an understanding of how scientific knowledge is developed.**

a) Explain how hypotheses often cause scientists to develop new experiments that produce additional data.
b) Demonstrate an understanding of fundamental scientific principals, such as Koch's Postulates, which affect experimental design.
c) Describe how testing, revising, and occasionally rejecting new and old theories are a continuous process.

GPS Academic Standards:

MM2P1 **Students will solve problems (using appropriate technology).**
MM2P3 **Students will communicate mathematically their ideas.**
MM2P4 **Students will make connections among mathematical ideas and to other disciplines.**

National / Local Standards / Industry / ISTE:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Scientific hypotheses and historical experimental discoveries have had and will continue to have a significant impact on future biotechnology discoveries and scientific data.

Essential Questions:

- What is the importance of understanding scientific inquiry and utilizing scientific principles in historical experimentation?
- How is scientific knowledge developed?
- What historical experimental events have lead to data and knowledge in biotechnology?
- Why is it important we understand the sequence of historical experimental scientific discoveries and theories in biotechnology?
- Why is testing and revision a continuous process in scientific inquiry?

Knowledge from this Unit:

Students will be able to:

- Describe how scientific inquiry and applying scientific principles have shaped experimental biotechnical research and the scientific knowledge base of today.
- Identify major historical experimental events in biotechnology.
- Discuss the sequence of biotechnical discoveries throughout history.

Skills from this Unit:

Students will be able to:

- Apply scientific principles to new hypotheses.

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
X Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
_____ Group project
X 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
_X_ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
_X_ 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
X Post-test

Assessment Attachments and / or Directions:

Unit 3 Test - Historical Experimental Events
Unit 3 Test – Historical Experimental Events KEY

LESSON PLANS

• LESSON 1: INTRODUCTION TO HISTORICAL EXPERIMENTAL EVENTS

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

HS-ABT-4 **Students will use inquiry to demonstrate an understanding of how scientific knowledge is developed.**

a) Explain how hypotheses often cause scientists to develop new experiments that produce additional data.

b) Demonstrate an understanding of fundamental scientific principals, such as Koch's Postulates, which affect experimental design.
c) Describe how testing, revising, and occasionally rejecting new and old theories are a continuous process.

2. Review Essential Question(s). Post Essential Questions in the classroom.

- What is the importance of understanding scientific inquiry and utilizing scientific principles in historical experimentation?
- How is scientific knowledge developed?
- Why is testing and revision a continuous process in scientific inquiry?

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

Cloning	Genetically Engineered	Monoclonal Antibody
DNA Polymerase	Human Genome	Recombinant DNA
Gene	Hypothesis	Scientific Method

4. Interest approach – Mental set

- Ask students to identify historical experimental events that have occurred in science and in biotechnology. Be prepared to give additional examples and lead the discussion as needed.

5. Review PowerPoint **The Scientific Method**. Discuss hypotheses formation and how the scientific process leads experimentation and discovery of results. Discuss Koch's Postulates, and how revisions to this principle have evolved in experimental design in the sciences.
   - See attached supplementary files

• LESSON 2: HISTORICAL EXPERIMENTAL DISCOVERIES IN BIOTECHNOLOGY

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

- What historical experimental events have lead to data and knowledge in biotechnology?
- Why is it important we understand the sequence of historical experimental scientific discoveries and theories in biotechnology?

2. Lead a discussion with these questions:

- When and where did Biotechnology begin?
- How has the field of Biotechnology evolved?
- What factors have influenced the progress in Biotechnology?

3. Distribute copies of **Scientists and Industry in Biotechnology.** Show/discuss PowerPoint **History of Biotechnology**, and complete worksheet as discussion continues. Evaluate the worksheet using the **Scientists and Industry in Biotechnology Key**.
   - See attached supplementary files

• LESSON 3: HISTORICAL TIMELINE IN BIOTECHNOLOGY

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

- What historical experimental events have lead to data and knowledge in biotechnology?
- Why is it important we understand the sequence of historical experimental scientific discoveries and theories in biotechnology?

2. Lead a general discussion about a historical biological time line:
    - What are time lines?
    - What is the purpose or function of a historical time line?
    - Display from internet sources examples of time lines to students so they understand the concept (ie. **http://www.accessexcellence.org/RC/AB/BC/**). Use multiple examples of biotechnology time lines.

3. Allow students to work individually or in pairs to construct or graph a time line of important Biotechnology Discoveries. Students should research historical and recent discoveries they feel are instrumental in contributing to the progress in the biotechnology field. Students should use a paper roll or graph paper to construct their time line. Students should follow requirements as outlined in **Historical Biotechnology Time Line Guidelines** to complete the project. Students should highlight significant biotech discoveries. Creativity is encouraged.
    - See attached supplementary files

4. Give a brief summary or ask students to give a summary of biotechnology from a historical perspective for the past century. Describe how scientific testing and revising of scientific theories has positioned us today in the field of biotechnology. Give examples from previously discussed material.

• LESSON 4: HISTORICAL BIOTECH RESEARCH

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

    - How is scientific knowledge developed?
    - What historical experimental events have lead to data and knowledge in biotechnology?
    - Why is testing and revision a continuous process in scientific inquiry?

2. Access the website: **http://www.accessexcellence.org/RC/AB/BC.** Display and discuss information from the website on Pioneer Profiles, Biotech Processes, Biotech Briefs, and Classic Biotech Stories to create an interest in research for the biotech research. Research other websites as needed to provide a historical overview in biotechnology and for student motivation with this activity.

3. Students will research an individual scientist, a biotechnology organization, or a biotech process. Students may work individually or in pairs to prepare a report on an important pioneer, biotechnology process or biotech organization, and their respective discovery or contribution. They should also address previous knowledge that was necessary to make that discovery. Students should emphasize obstacles overcome in regards to the scientific process that lead up to that discovery.

4. Students will give an oral report after they finish the written report. Use **Historical Biotech Research Guidelines** to evaluate the student's understanding and success of the project.
    - See attached supplementary files

• ATTACHMENTS FOR LESSON PLANS

The Scientific Method

Scientists and Industry in Biotechnology
Scientists and Industry in Biotechnology - Key
History of Biotechnology
Historical Biotechnology Time Line Guidelines
Historical Biotech Research Guidelines
Unit 3 Test - Historical Experimental Events
Unit 3 Test - Historical Experimental Events - Key

- **NOTES & REFLECTION:**

One of the most important factors in this unit is that the teacher is prepared and able to provide materials and previous website research of the subject matter in each lesson.

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:

http://www.accessexcellence.org/RC/AB/BC
http://www.biotechinstitute.org/what_is/timeline.html
http://www.woodrow.org/teachers/bi/1993/intro.html

Materials & Equipment:

- Computer & Presentation Software
- Time Line Construction Materials

21st Century Technology Used:

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