GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

HEALTHCARE SCIENCE

PATHWAY: Biotechnology Research & Development

COURSE: Applications of Biotechnology

UNIT 10: Evaluation of Biotech Company

INTRODUCTION

Annotation:

This unit will allow students to see the role of a Biotechnology company in the development of products that contribute to the advancement of various fields including forensics, cell biology, cancer treatment, infectious disease studies, nanotechnology, bioinformatics, genomics, stem cell research, transgenics, and gene therapy.

Grade(s):

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

Time:

Ten 50-minute class periods

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-2 **Students will demonstrate how advanced techniques in biotechnology contribute to our quality of life.**

a) Describe how biotechnology has contributed to the advancement of biology impacting human well-being, such as disease management through vaccines, food production, materials science and molecular identification.

b) Apply biotechnological techniques to forensics including materials analysis, DNA fingerprinting and sample collection.

c) Utilize biotechnology for healthcare applications.

- Utilize biotechnology for diagnostic applications (*e.g*. hepatitis, HIV, BRAC, rapid streptococcus).
- Explain the role of biotechnology in therapeutics (*e.g.*, gene therapy, vaccines. antibody therapy, cell therapy).
- Describe how bioinformatics can be used to predict disease and determine treatment.
- Investigate the principles of genetic mapping applied to healthcare or phylogenetics and evolution (*e.g.*, AFLP, RFLP, SNPs, etc.).

d) Describe the non-medical applications of biotechnology including enzyme production, biofuel and biomaterials discovery and manufacturing.

GPS Academic Standards:

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

ELA10C1 The student demonstrates understanding and control of the rules of the English language, realizing that usage involves the appropriate application of conventions and grammar in both written and spoken formats.

ELA10LSV1(d) Actively solicits another person's comments or opinion. (e) Offers own opinion forcefully without domineering.

UNDERSTANDINGS & GOALS

Enduring Understandings:

- Biotechnology is a new science field which includes many modern techniques that involve deoxyribonucleic acid (DNA), such as recombinant DNA technology, polymerase chain reaction, and cloning.
- Biotechnology focuses on the research and development of products from plant and animal cells.
- Biotechnology companies focus on product development or manufacturing to make a financial profit.
- Biotechnology has greatly contributed to the advancement of biology by positively impacting human.
- Major areas that have been impacted by biotechnology are: forensics, cell biology, cancer treatment,epidemiology of infectious diseases, nanotechnology, bioinformatics, genomics, stem cell biology, transgenics, and gene therapy.
- Biotechnology companies provide employment for many different types of employees to include scientific and nonscientific careers.

- The personal qualities of employees of biotechnology companies should include curiosity, honesty, openness and skepticism because the goods and services provided by them can directly affect the health and well being of people.

Essential Questions:

- What are some ways that biotechnology has contributed to the advancement of biology?
- What are the major areas that have been impacted by biotechnology?
- What is the history of the biotechnology industry?

- What are some of the job positions that are required to run a biotechnology company?
- What are some of the important personal qualities that employees of biotechnology companies should possess?

Knowledge from this Unit:

Students will be able to:

- Explain how genes are produced in organisms
- Describe how genes can be recombined with genes of another organism
- Explain how altering the genetic code causes an alteration in proteins produced
- Describe the role of enzymes in DNA and protein production
- Explain the Central Dogma
- Evaluate the role of genomics and proteomics in the development of biotechnology products
- List the education required for the different titles given to biotechnology company employees
- List the major categories for biotechnology companies based on the products they make and sell

Skills from this Unit:

Students will be able to:

- Isolate and purify DNA
- Utilize the scientific method to answer questions.

ASSESSMENTS

Assessment Method Type:

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ 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
_x_ Observe students working with partners
_x_ Observe students role playing

_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
_____ Dialogue and Discussion
_x_ Student/teacher conferences
_x_ Partner and small group discussions
_x_ 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

LESSON PLANS

• LESSON 1: THE NEW AGE OF BIOTECHNOLOGY

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

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

- What are some ways that biotechnology has contributed to the advancement of biology?
- What are the major areas that have been impacted by biotechnology?

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

Nanotechnology	Bioinformatics	Transgenetics
Stem cells	Gene therapy	

4. Interest approach – Mental set

- Take the students to the Georgia Bio website to show them the number and kind of biotechnology companies in Georgia. Lead a discussion about the type of products that are produced by biotechnology companies. List the 4 major types of companies and allow the students to place the

products with the types of companies (Industrial and Environmental, Medical/Pharmaceutical,Diagnostic/Research, and Agricultural).

5. The teacher will divide the class into 4 separate groups and allow them to brainstorm ways of organizing this information by categories.

6. Each group will present their information to the class. The information will be listed on large post it notes to be displayed and added to throughout the unit.

• LESSON 2: CENTRAL DOGMA

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

    - How are proteins produced in an organism?

2. Ask the students to make a brochure of their imaginary company that specifically works on one of the technologies eg. Stem cell research or bioinformation and explain the role of the central dogma in their process.

• LESSON 3: HISTORY OF BIOTECHNOLOGY

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

    - What is the history of the biotechnology industry?

2. The teacher will lead a discussion to help students understand that genes have been manipulated throughout history. Groups of students will be given register tape and instructed to trace the history starting with 1760 and using the internet as their research tool. They will make a mark every cm along the bottom of the tape to represent 20 years each.

3. Each group will be given time to present their time line and secure their timeline in the student work section of the room if it is done completely.

• NOTES & REFLECTION:

The students will understand that there are many useful proteins that are used in our lives. Proteins are produced normally by specific cells within an organism. Biotechnology is the manipulation of a cell to produce a protein which that it does not naturally produce. As new techniques and equipment are produced, we are able to manipulate the production of more proteins. This has led to organizations that are set up throughout the world for the purpose of capitalizing on this phenomenon.

CULMINATING PERFORMANCE TASK

Culminating Unit Performance Task Title: Comparing DNA

Students will compare the DNA extracted from the various organism to see which ones are the most closely related.

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

After the DNA extraction lab, students will align their gels close to each other. Each group will analyze the gels and determine which ones they think are the most closely related. Each group will report their findings with justifications. Example of several gels placed side by side for analysis and practice before attempting the culminating project.

UNIT RESOURCES

Web Resources:

- Georgia Bio -**www.gabio.org**

Materials & Equipment:

- Gel electrophoresis kit

21st Century Technology Used:

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