GEORGIA MIDDLE SCHOOL Instructional Resources

CAREER, TECHNICAL, & AGRICULTURAL EDUCATION

HEALTHCARE SCIENCE

COURSE: Healthcare Science

UNIT 6: Introduction to Biotechnology Services

INTRODUCTION

Annotation:

In this unit students will define biotechnology and related sciences and then evaluate careers choices in the field of biotechnology. The fields of microbiology, toxicology, biomedical engineering, genetics, and forensics will be explored.

Grade(s):

	6th
X	7th
	8th

Time:

Twelve 50 minute periods

Author:

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Additional Author(s):

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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 appropriately. 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. Many students (both with and without disabilities) who struggle with reading may benefit from the use of text reading software or other technological aids to provide access to printed materials. Many of these are available at little or no cost on the internet.

FOCUS STANDARDS

GPS Focus Standards:

MSHS7-HS-7-- Students will evaluate career choices in the biotechnology field.

a) Compare and contrast the roles and responsibilities of workers in the field of genetics, biomedical engineering, toxicology, microbiology, and forensics, along with their education, training requirements, salary ranges, job outlooks, and facilities in which they work.

b) Describe computer applications and biomedical devices in healthcare.

c) Explore the structure of DNA and its relationship to the cell.

d) Evaluate forensic techniques.

e) Analyze the benefits of biomedical research.

f) Differentiate the ABO and Rh blood types.

g) Sample tasks – Demonstrate at least one of the following:

- Separating DNA.
- Testing of simulated blood for ABO and Rh type.
- Fingerprinting.
- Identification of bacteria.
- Researching and debating a selected bioethical issue.
- Creation or interpretation of a pedigree chart showing the inheritance of a genetic disease.

GPS Academic Standards:

S7CS2 – Students will use standard safety practices for all classroom laboratory and field investigations.

S7CS4 – Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.

S7CS6 – Students will communicate scientific ideas and activities clearly.

S7L3 – Students will recognize how biological traits are passed on to successive generations.

M7D1 – Students will pose questions, collect data, represent and analyze the data, and interpret results.

M7G3 – Students will use the properties of similarity and apply these concepts to geometric figures.

National / Local Standards / Industry / ISTE:

1.22 – Investigate biomedical therapies as they relate to the prevention, pathology, and treatment of disease.

1.35 – Analyze diagrams, charts, graphs, and tables to interpret healthcare results.

4.31 – Compare potential health science career pathways using a variety of health careers within the diagnostic services, therapeutic services, health informatics services, support services, or biotechnology research and development.

4.32 – Recognize levels of education, credentialing requirements, employment opportunities, workplace environments, and career growth potential for a service area.

6.14 – Recognize ethical issues and their implications related to healthcare.

UNDERSTANDING & GOALS

Enduring Understandings:

Students will understand the broad field of biotechnology and how advances in Biotechnology affect and will affect their lives in the future.

Essential Questions:

- How will discoveries in Biotechnology affect my life?

Knowledge from this Unit:

- Students will know how to prepare for various biotechnology careers.
- Describe computer applications and biomedical devices used in healthcare today
- Students will analyze the benefits of biomedical research

Skills from this Unit:

- Explain the structure of DNA and its relationship to the cell.
- Students will be able to interpret a Punnett square and pedigree chart.

ASSESSMENTS

Assessment Method Type: Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
_____ 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 and commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
_____ Dialogue and Discussion
__ Student/teacher conferences
__ 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(s) Title:

Assessment(s) Description/Directions:

Attachments for Assessment(s): Please list.

• INTRODUCTION

1. Identify the Standards. Standards should be posted in the classroom for each lesson.

MSHS7-HS-7-- Students will evaluate career choices in the biotechnology field.

a) Compare and contrast the roles and responsibilities of workers in the field of genetics, biomedical engineering, toxicology, microbiology, and forensics, along with their education, training requirements, salary ranges, job outlooks, and facilities in which they work.

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g) Sample tasks – Demonstrate at least one of the following:

• Separating DNA.

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• Fingerprinting.

• Identification of bacteria.

• Researching and debating a selected bioethical issue.

• Creation or interpretation of a pedigree chart showing the inheritance of a genetic disease.

2. Review Essential Questions.

- How will discoveries in Biotechnology affect my life?

3. Identify and review the unit vocabulary.

- Biotechnologist
- Drug toxicology
- Transfusions
- The Human Genome

4. Assessment Introduction.

• LESSON 1: OVERVIEW OF BIOTECHNOLOGY

Objective - Students will compare and contrast the roles and responsibilities of workers in the field of Biotechnology.

1. To begin the lesson (find news article on subject) covering microbiology, toxicology, biomedical engineering, genetics and forensics current events.
2. After the video conduct a brief class discussion: Ask students to share two to three sentences about a topic of interest seen in the clip.
3. Present the attached PowerPoint **HS_7-6_Intro to Biotechnology Services**. The PowerPoint covers a general overview of the following Biotechnology careers:
    - Microbiology
    - Toxicology
    - Biomedical Engineering
    - Genetics
    - Forensics

    Note: This PowerPoint will also be used in the following lessons in more detail. So only a quick overview of the careers using the PowerPoint should be done in Lesson One.

4. Following the PowerPoint presentation, have the students complete a written assignment. Have the students choose one of the career areas discussed in the previous PowerPoint. Then instruct the students to write a paragraph of at least eight sentences describing why you are interested in this topic

• LESSON 2: MICROBIOLOGY

Objective – Students will learn about the field of microbiology.

1. Give a mini lecture on Microbiology.
2. Definition: Microbiology- branch of biology that studies microorganisms and their effects on humans
3. Discuss the basics of microbiology with the students and what is required to become a microbiologist. Use the attached PowerPoint **HS_7-6_Intro to Microbiology**

• LESSON 3: BLOOD TYPES

Objective – Students will explore skills in the field of Microbiology.

1. Present the PowerPoint used previously in Lesson 1 **HS_7-6_Intro to Biotechnology Services**:
2. Definition: Blood and transfusions
3. Simulated blood typing using Ward's Simulated Blood Typing Kit
4. Perform lab testing to determine the blood type of four patients.
5. Career Research may be done using the U.S. Department of Bureau of Labor Statistics website: http://www.bls.gov/oes/current/oes191022.htm

• LESSON 4: TOXICOLOGY

Objective – Students will research information about careers in Toxicology.

1. Present the slides on Toxicology in the PowerPoint **HS_7-6_Intro to Biotechnology Services**
2. Definition: Drug toxicology
3. Explain the Toxicology Research Activity with the students. Project directions for this project are described in the PowerPoint. The students will work in pairs for this assignment.
4. For this assignment refer to the Toxicology Research Handouts and Pie chart and bar graph analysis. The attachments used for Lesson 3 Toxicology are:

   HS_7-6_Toxicology_Colleges Offering Degrees in Toxicology
   HS_7-6_Toxicology_How do I prepare for a Career in Toxicology Research Handout
   HS_7-6_Toxicology_What is Toxicology Research Handout
   HS_7-6_Toxicology_Where Do Technologist Work Research Handout Part 1
   HS_7-6_Toxicology_ Where Do Technologist Work Research Handout Part 2
   HS_7-6_Toxicology_ Where Do Technologist Work Research Handout Part 3

5. Have the students give their presentations on Toxicology**.** Use the attachment **HS_7-6_Oral Presentation Rubric Toxicology**

• LESSON 5: BIOMEDICAL ENGINEERING

Objective – Students will describe computer applications and biomedical devices created by DEKA, a technology company.

1. Discuss with the students the advancements made in biomedical engineering. One example is the DEKA arm. For a summary of this project use the attachment **HS_7-6_DEKA arm reading and questions**
2. Show the students the video clip of DEKA arm:
   DEKA Arm video (12 minutes): http://news.cnet.com/8301-11386_3-10217855-76.html
   DEKA website: http://www.dekaresearch.com/deka_arm.shtml
3. With the class, lead a discussion of the impact of DEKA developments.

• LESSON 6: GENETICS

1. Present a mini – lecture that covers genetic basics and vocabulary. Use the PowerPoint **HS_7-6_Intro to Biotechnology Services** and cover the section on Genetics.
2. The vocabulary attachment for this mini-lecture is **HS_7-6_Genetics_Introduction to Genetics Vocabulary**
3. Teacher Note: Lesson 6 is just an overview of genetics. Genetics will also be covered in Lessons 7-9. The next three lessons will cover:

   Lesson 7-Genetic Basics:
   Group Lab Experiment: Separating DNA

   Lesson 8-Heredity: It's in your Genes:
   Create a Punnett Square
   Create a Pedigree Chart
   Use of Punnett Squares and Pedigree charts used in Gene Therapy

   Lesson 9-Stem Cell Research and Therapy:
   Internet interactive: Stem Cell Guy
   http://learn.genetics.utah.edu/content/tech/stemcells/scintro/

Note: Refer to the attachment **HS_7-6_Genetics Intro to Genetics Teacher Notes** for more description regarding lesson 6.

• LESSON 7: DNA SEPARATION EXPERIMENT

1. Review the basics of genetics with the class.
2. Conduct the Activity - DNA Separation Experiment as a class. Use the attachment, **HS_7-6_Genetics DNA Separation Questionnaire**.

Note: Refer to the attachment **HS_7-6_Genetics Intro to Genetics Teacher** Notes for more description regarding lesson 7.

• LESSON 8: GENETIC INHERITANCE

1. Use the PowerPoint **HS_7-6_Intro to Biotechnology Services** and present the information on Genetic Inheritance
2. Conduct the Activities: Create Punnett squares and pedigree charts
3. Use the attachments:

   HS_7-6_Genetics DNA Separation Questionnaire
   HS_7-6_Genetics Punnett Square and Pedigree Chart Activity One
   HS_7-6_Genetics Punnett Square and Pedigree Chart Activity Two

Note: Refer to the attachment **HS_7-6_Genetics Intro to Genetics Teacher Notes** for more description regarding lesson 8.

• LESSON 9: WHAT IS A STEM CELL?

1. Conduct the Stem Cell Guy Internet Interactive Activity from www.learn.genetics.utah.edu.
2. Have the students work in pairs for the activity. There is an attached study guide, **HS_7-6_Stem Cells Research Questionnaire**, which students should complete for this activity.

Note: Refer to the attachment **HS_7-6_Genetics Intro to Genetics Teacher Notes** for more description regarding lesson 9.

• LESSON 10: FORENSICS

1. Review with the class the Stem Cell guy study guide from lesson 9
2. Give a short lecture introducing the field of forensics to the class. Use the attachments:
   HS_7-6_Intro to Biotechnology Services
   HS_7-6_Forensics Intro to Forensics Teacher Notes
   HS_7-6_Forensics Intro to Forensics Vocabulary
3. Lead a discussion with the class by asking: How is knowledge and technological development of DNA separation used by police?
4. Additional possible reference: http://sciencespot.net/Pages/kdzforsci.html
5. Incorporating Mathematics. Give students the worksheet **Using Math in Forensic Science.** This worksheet shows the students how math is used in identifying skeletons in forensics. The answer key is attached.

• LESSON 11: DNA DETECTIVE

1. Conduct the activity DNA Detective with the class. Use the attachment **HS_7-6_DNA Detective Solve the Crime**.
2. Go to the Try Science website: www.tryscience.org
3. Click "View all Experiments" at the bottom right of orange folder.
4. Click on Number 7: Technology and Engineering.
5. From the list of activities on the right, click DNA Detective.
6. Click "Try it online." This may take a couple of minutes to load.
7. Ask Students: In lab, can you solve the crime? Find out how DNA profiling can make sense of a crime scene.
8. Hand out the attached worksheet for the students to answer the questions and begin the activity.
9. Select **DNA Basics** and answers questions to Part One: DNA basics. Then select **Crime Scene Investigation** and answers questions to Part Two: Crime Scene Investigation. To complete this activity, select the **Lab** and answer questions in Part Three: Go to the Lab!

• ATTACHMENTS FOR LESSON PLANS

HS_7-6_Intro to Biotechnology Services
HS_7-6_Intro to Microbiology
HS_7-6_Toxicology_Colleges Offering Degrees in Toxicology
HS_7-6_Toxicology_How do I prepare for a Career in Toxicology Research Handout
HS_7-6_Toxicology_What is Toxicology Research Handout
HS_7-6_Toxicology_Where Do Technologist Work Research Handout Part 1
HS_7-6_Toxicology_Where Do Technologist Work Research Handout Part 2
HS_7-6_Toxicology_Where Do Technologist Work Research Handout Part 3
HS_7-6_Oral Presentation Rubric
HS_7-6_DEKA arm reading and questions
HS_7-6_Genetics_Introduction to Genetics Vocabulary
HS_7-6_Genetics DNA Separation Questionnaire
HS_7-6_Genetics Punnett Square and Pedigree Chart Activity One
HS_7-6_Genetics Punnett Square and Pedigree Chart Activity Two
HS_7-6_Genetics Intro to Genetics Teacher Notes
HS_7-6_Stem Cells Research Questionnaire
HS_7-6_Forensics Intro to Forensics Teacher Notes
HS_7-6_Forensics Intro to Forensics Vocabulary
HS_7-6_DNA Detective Solve the Crime
HS_7-6_Using Math in Forensic Science

• NOTES & REFLECTION:

Closure:
1. What Biotechnology field of study interested you most?
2. Which Biotechnology skill or activity did you find most enjoyable?
3. Discuss some ways Stem Cell Research can benefit health.
4. Describe the field of Forensics and how are the used to solve a crime?

Transfer out:
Now that we have learned about Biotechnology take a few seconds think about this scenario. In an attempted robbery, a store clerk is hit over the head with a baseball bat. The criminal becomes frightened, leaves the scene. The store clerk makes an initial phone call. Who does he call? (911) Who is dispatched to the scene? (Police and ambulance). In our next unit, we will learn about careers in the field of Emergency Services.

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.dekaresearch.com/deka_arm.shtml

www.deka.com

www.learn.genetics.utah.edu

http://sciencespot.net/Pages/kdzforsci.html

www.tryscience.org

Attachment(s):

Using Math in Forensic Science

Materials & Equipment:

- Computer
- Internet online websites
- Internet online career videos
- Simulated blood typing kit
- Supplies for DNA separation experiment

What 21st Century Technology was used in this unit?

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	X	Video
	Animation Software		Wiki		Electronic Game or Puzzle Maker
	Email	X	Website		