

TIES 2003

Teachers in Industry for Educational Support

Biotechnology: The New Frontier



Developed by:

Sharon Riley - Springfield North H.S. Biotechnology Tech Prep

Marc Cary - Centerville H.S. Biotechnology Tech Prep

Table of Contents

	<u>Page</u>
Curriculum Unit Overview - narrative	#3
Summary Chart	#4
Section One Presentation Skills	#5
Section Two Laboratory Applications	#6
Section Three Biotechnology In The News	#8
Transfer Activity Biotechnology Newsletter	#10
Appendix Lesson Plan Handouts	#13

Biotechnology: the New Frontier

Curriculum Unit Overview

Summary

This course is designed for students entering a new biotechnology tech prep course for eleventh grade students. Biotechnology is a very new field. Most students who enter this program have only a limited knowledge of the career opportunities that await them. This unit is designed to give them a better understanding of their career choices and the type of work performed in each career. Because this is an introductory unit, the students will only be expected to gain a limited knowledge of each type of career. We will go into more depth as each area is introduced and explored throughout the school year.

The anticipated time needed to complete this unit is about fifteen hours.

This unit can easily be adapted to a variety of other courses.

Big Picture

A PowerPoint presentation featuring clips from popular T.V. shows and other interesting visual aids will be used to facilitate a class discussion on biotechnology and the career opportunities for students in this field.

Preparation for the Unit

Work with your school to:

1. Procure audio visual equipment including a computer and a LCD projector.
2. Order the pGLO lab from Bio-Rad.
3. Schedule time in the library.
4. Photocopy all student handouts.
5. Purchase or borrow the necessary lab equipment as defined in the instructions for the pGLO lab.

Overview

On the following page is a summary of the unit including brief summaries of each Authentic Learning Task (ALT). This table provides an overview of the tasks in the unit sections and shows how the activities in the different teaching areas relate to each other.

Biotechnology: The Third Frontier

Curriculum Unit Summary

Presentation Skills	Laboratory Applications	Biotechnology in the News
<p>ALT 1 - <u>Careers in Biotechnology</u> This activity is designed to raise student awareness of the fast growing field of biotechnology while developing basic computer and communication skills through individual research and presentation.</p>	<p>ALT 1 – <u>pGLO Lab</u> The students will transform bacteria by inserting a gene that will make the bacteria glow under black light.</p>	<p>ALT 1 – <u>Scrapbook</u> This activity permits students to explore the many different resources available for obtaining information pertaining to the biotechnology industry by having them construct a scrapbook of current articles and pictures.</p>
<p>Transfer or Culminating Activity <u>Biotechnology Newsletter</u></p> <p>Students will develop a biotechnology newsletter for distribution to parents, staff and students. Each student will, individually or in a small group, construct a small portion of the newsletter based on the information s/he has gained through the above ALTs. The newsletter will serve as a collaborative effort to combine the presentation, technological, and resource skills students need to compete in today's biotechnology industry.</p>		

Section One: Presentation Skills

ALT One: Careers in Biotechnology

Summary

Students will be instructed to do research on various career fields in the biotechnology industry. Students will use their findings to develop a Powerpoint slide show for presentation to their classmates and instructor.

Competencies

1. Data Retrieval/Research
2. Use of modern software programs and computer technology for the sharing of ideas and concepts.
3. Presentation skills
4. Effective public speaking

Time

5-8 hours of class time will be given to students for the purposes of preliminary instructions, internet and school computer use, library visits, one on one instruction, and individual presentations.

Materials

1. Computer with MS PowerPoint installed (one per student)
2. Internet access
3. Careers in Biotechnology Project Sheet (ALT One: Handout 1)
4. Oral Presentation Evaluation Sheet (ALT One: Handout 2)

Instructions

1. see Careers in Biotechnology Project Sheet (ALT One: Handout 1)

Evaluation/Assessment of Student's Competency

As per the instructions given on the Careers in Biotechnology Project information sheet (ALT One: Handout 1), students will be evaluated based on the completeness of their research as well as the quality of their oral presentation. The criteria and points to be awarded for each of these categories is listed on the Careers in Biotechnology Project information sheet and the Oral Presentation Evaluation sheet (ALT One: Handouts 1 and 2 respectively). A maximum total of 150 points will be awarded to students accordingly.

Closure

The lesson will be concluded with a class discussion of the many different career opportunities available to the students and their individual interests in these areas. The next learning activity provides students with an opportunity to perform hands-on laboratory work involving a typical biotechnology procedure in order to help them better understand the technological skills necessary to perform in this field

Section Two: Laboratory Applications

ALT One: pGLO Lab

Summary

Students will transform ordinary bacteria by adding a gene that will cause the bacteria to glow under black light.

Competencies

1. The student will be able to follow proper safety procedures necessary for a lab of this type. 100% accuracy is required.
2. The student will be able to follow the appropriate laboratory protocol for this lab (as described in the lab manual). 100% accuracy is required.
3. The student will be able to explain verbally and in written form what has happened during this lab and how it reflects on current practices in the field of biotechnology. 100% accuracy is required.

Time

1. Allow 30 minutes to complete a class discussion exploring the concept of inserting a new gene into an existing organism to change the organism.
2. The initial set up of the lab will take about 60 minutes.
3. The prepared plates must stay in an incubator for 24 hours after step one.
4. Examine the plates using the black light during class on the following day. Allow students 45 minutes to examine their results and write up their conclusions.
5. Allow 30 minutes for an in-class discussion of the lab and your results.
6. TOTAL TIME: 90 minutes in class to start the project, 24 hours in the incubator and 45 minutes to finish the project on the following day. Also allow 30 minutes for an in-class discussion of the lab.

Materials

1. pGLO Bacterial Transformation kit #166-0003EDU from Bio-Rad
2. Student handout (provided in kit). One per student.
3. Ice
4. Warm water bath
5. Appropriate safety gear (goggles, lab coat, gloves)
6. Incubator
7. Black light

Section Two: Laboratory Applications

ALT One: pGLO Lab

Instructions

1. Complete a class discussion exploring the concept of transforming bacteria by inserting a new gene.
2. Using the lab protocol, complete steps 1-12.
3. Remove the agar plates from the incubator.
4. Turn off the classroom overhead lights and examine the plates using a black light.
5. Record your observations.
6. Write up a lab report detailing your lab and your results.
7. Discuss your results with your class

Evaluation/Assessment of Student's Competency

1. The students will be assessed on the proper use of safety procedures during the lab by visual observation of the instructor.
2. The students will be assessed on their ability to complete the lab following the correct protocol as explained in the lab handout. This will be evaluated visually by the instructor.
3. The students will be evaluated on their ability to verbally discuss the lab and their results in a class discussion through teacher observations during the discussion.
4. The students will be evaluated on their ability to correctly summarize their work in a written lab report using the lab report rubric (Handout 3).

Closure

The students will discuss their results in class. They will also discuss current applications of this activity in the field of biotechnology. And they will theorize other situations in which this type of procedure would be of value.

The students will then bring in articles that relate to their field found in local newspapers and magazines. They will write a brief description of the article and add the article and the summary to their class scrap book.

Section Three: Biotechnology in the News

ALT One: Scrapbook

Summary

Students will compile a class scrapbook of current newspaper, journal and internet articles pertaining to various fields of biotechnology in order to accumulate text and graphics for future projects.

Competencies

1. Utilizing relevant publications to learn about the latest news in biotechnology.
2. Following industry trends and discoveries
3. Developing topics for class discussion and reflection.

Time

Approximately 3 Hours.

Materials

1. Computers with Internet access
2. School library or IMC Access (Sign up in advance if necessary)
3. Extra large three-ring binder
4. Scrapbook Instruction sheet (Handout 5)

Instructions

1. Pass out scrapbook instruction sheet (Handout 5)
2. Instruct students that they are required to work individually at finding articles on biotechnology which they will share with their classmates on the final day of the project and place in a scrapbook for future use.
3. Allow students approximately two hours to work in a library media center to retrieve articles from newspapers, scientific journals, and the internet.
4. Allow students approximately one hour to present and discuss several of their favorite articles with the class.
5. Instruct students to place all articles in an extra large three ring binder for future use.

Evaluation/Assessment of Student's Competency

Student achievement will be assessed using the criteria set forth in the Scrapbook Instruction Sheet (Handout 5). Areas of competency open for evaluation are number of sources, number of articles, article relevancy, clarity of article presentation, and comprehension of article content.

Section Three: Biotechnology in the News

ALT One: Scrapbook

Closure

Following the student presentations, a group-wide discussion will be conducted that focuses on informing school staff, parents, and the student body about the impact of today's biotechnology on our society. This discussion will serve as a lead-in to the next (culminating) activity which is the assembly and distribution of a biotechnology newsletter.

Transfer Activity

Summary

The students will create a newsletter to share with their families and the school explaining what biotechnology is and what career fields exist in this area. It will also contain some recent applications of biotechnology that have been featured in newspapers, journals, magazines or other publications.

Competencies

1. The students will be able to write accurate, concise, informative and interesting articles on biotechnology.
2. The students will be able to work as a member of a team to create a unique project.
3. The students will be able to compile the work of their class into a coherent newsletter.

Time

1. The students will require about four hours to complete this activity.

Materials

1. The class scrapbook created in an earlier lesson.
2. Newsletter Article Handout (Handout #6)
3. Microsoft Publisher or a similar software package or handout #4.
4. Computer access for the entire class for the duration of the project.

Instructions

1. Place the students in small groups (2-3).
2. Assign a topic area to each group based on their scrapbook assignment topics.
3. Each group will create a newsletter article based on two or more scrapbook articles.
4. They will follow the newsletter protocol as described in handout 6.
5. Allow one member from each group to become the editors of the newsletter.
6. The editors will incorporate the articles produced by each group into the class newsletter.
7. The other students will select pictures or other visual aids to add to the newsletter and give them to the editors.
8. The final project will be approved by the teacher and then produced by the school's printing class (if available) or by the teacher.

Transfer Activity

Evaluation/Assessment of Student's Competency

The students will be assessed on their article using the following rubric. They will also be assessed on their ability to function well as a member of a team.

Teacher name:

Student Name _____

CATEGORY	4	3	2	1
Focus on Topic (Content)	There is one clear, well-focused topic. Main idea stands out and is supported by detailed information.	Main idea is clear but the supporting information is general.	Main idea is somewhat clear but there is a need for more supporting information.	The main idea is not clear. There is a seemingly random collection of information.
Support for Topic (Content)	Relevant, telling, quality details give the reader important information that goes beyond the obvious or predictable.	Supporting details and information are relevant, but one key issue or portion of the storyline is unsupported.	Supporting details and information are relevant, but several key issues or portions of the storyline are unsupported.	Supporting details and information are typically unclear or not related to the topic.
Accuracy of Facts (Content)	All supportive facts are reported accurately.	Almost all supportive facts are reported accurately.	Most supportive facts are reported accurately.	NO facts are reported OR most are inaccurately reported.
Flow & Rhythm (Sentence Fluency)	All sentences sound natural and are easy-on-the-ear when read aloud. Each sentence is clear and has an obvious emphasis.	Almost all sentences sound natural and are easy-on-the-ear when read aloud, but 1 or 2 are stiff and awkward or difficult to understand.	Most sentences sound natural and are easy-on-the-ear when read aloud, but several are stiff and awkward or are difficult to understand.	The sentences are difficult to read aloud because they sound awkward, are distractingly repetitive, or difficult to understand.
Grammar & Spelling (Conventions)	Writer makes no errors in grammar or spelling that distract the reader from the content.	Writer makes 1-2 errors in grammar or spelling that distract the reader from the content.	Writer makes 3-4 errors in grammar or spelling that distract the reader from the content.	Writer makes more than 4 errors in grammar or spelling that distract the reader from the content.
Introduction (Organization)	The introduction is inviting, states the main topic and previews the structure of the paper.	The introduction clearly states the main topic and previews the structure of the paper, but is not particularly inviting to the reader.	The introduction states the main topic, but does not adequately preview the structure of the paper nor is it particularly inviting to the reader.	There is no clear introduction of the main topic or structure of the paper.
Transitions (Organization)	A variety of thoughtful transitions are used. They clearly show how ideas are connected.	Transitions clearly show how ideas are connected, but there is little variety.	Some transitions work well; but connections between other ideas are fuzzy.	The transitions between ideas are unclear or nonexistent.
Conclusion (Organization)	The conclusion is strong and leaves the reader with a feeling that they understand what the writer is "getting at."	The conclusion is recognizable and ties up almost all the loose ends.	The conclusion is recognizable, but does not tie up several loose ends.	There is no clear conclusion, the paper just ends.

Transfer Activity

Closure

The students will each read a copy of their newsletter. They will participate in a class discussion of the articles and how they are presented. The students will be encouraged to provide positive comments about each of the articles.

The newsletter will be distributed to the homes of all of the students that attend the school as part of the parent newsletter.

Appendix One: Lesson Plan Handouts

Biotechnology: The New Frontier Handout 1

Careers in Biotechnology Project

Name _____

Date _____

Your assignment is to research a career in the field of biotechnology. You will then use your findings to develop a high quality PowerPoint presentation depicting the career you have chosen. You may choose any biotechnology career you like; however, only one student per career is allowed. If someone else has already selected a career position that you wanted, you will have to pick another one. Also, all of the following information should be present in your final product in order to receive full credit.

- _____ 1. Title of career (Be specific)
- _____ 2. Amount of education required (How many years of college, degree needed)
- _____ 3. Major tasks (What kind of things does a person in this field do?)
- _____ 4. Salary range
- _____ 5. Demand/Shortage? Future outlook?
- _____ 6. Local colleges offering degree programs in this field.
- _____ 7. Possible employers (List several local employers if possible)
- _____ 8. Large, full color picture of something relevant to this career.

- _____ TOTAL

Each of the above items is worth 10 points toward the final grade. The remaining 70 points will be awarded for the oral presentation of the material. See the following evaluation form for point breakdown of presentation.

Powerpoint = 80pts
Presentation = 70pts
TOTAL = 150pts

Biotechnology: The New Frontier Handout 2

Oral Presentation Evaluation Sheet

Presenter: _____

Project Title: _____

*The presentation grade will be determined by the following (70pts):

_____ **Eye Contact** (Was eye contact maintained with the audience?) 5pts

_____ **Voice** (Was the voice enthusiastic, clear, and audible?) 5pts

_____ **Presentation** (Was the presenter organized, well-prepared, and ready?) 10pts

_____ **Visual Aids** (Were charts, graphs, illustrations, etc. neat, clear, and visible?) HINT: font must be 24 or larger on Power point. 25pts

_____ **Knowledge** (Does presenter seem to know topic, answer questions and give explanations? 25pts

_____ **TOTAL**

Comments: _____

Biotechnology: The New Frontier Handout 3

Laboratory Report Rubric

Cover Page

- 5 All components present (title, date, name), properly spaced, correct font, attractive presentation.
- 3 All components present, but improper format.
- 1 One or more components missing.

Introduction

- 5 Background information, objective and rationale of lab present and complete.
- 3 All components present but material is incomplete.
- 1 At least one component is missing or all components are poorly presented.

Materials

- 5 All needed materials are listed and properly presented.
- 3 One or two needed materials are missing or format is incorrectly done.
- 1 More than two needed materials are missing.

Procedure

- 5 A step-by-step format is used. All steps are present in the correct order.
- 3 All steps are present but they aren't in the correct order.
- 1 One or more steps are missing and/or sequence has several inaccuracies.

Results

- 5 Only the actual results from the lab are present. All lab data is present and appropriately summarized. No conclusion is made relative to the results.
- 3 Results are present but not supported by the actual lab data or lab data is not accurately summarized.
- 1 Results are poorly explained or inaccurate based on the lab data. Or the lab data is not present.

Conclusion

- 5 Conclusion is logical and based on the results produced by the lab. Conclusion is well explained and supported.
- 3 Conclusion is logical based on the lab results but not well explained or supported.
- 1 Conclusion does not reflect lab results.

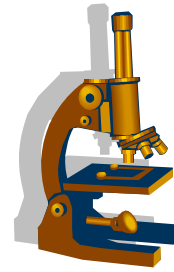
Works Cited

- 5 All referenced sources are properly cited in the text and on the Works Cited page.
- 3 Citations are all present but improperly formatted.
- 1 At least one citation is missing.

Biotechnology: The New Frontier Transfer Activity: Handout 4



Today's



Biotechnology

Biotechnology: The New Frontier ALT One: Handout 5

Scrapbook **Information Sheet**

Objective:

Begin familiarizing yourself with the many different resources available for obtaining current information regarding biotechnology.

Procedure:

A. Collect five current articles on biotechnology from at least three different sources. Each article should involve one of the following major topics in biotechnology; however, any given topic should only be used for one article.

1. Forensics
2. Stem Cell Research
3. Human Cloning
4. Genetically Modified Foods
5. The Human Genome Project
6. Microbial Biotechnology
7. Pharmaceuticals
8. Environmental Preservation
9. Bioethics
10. Animal Biotechnology

B. Pick two or three articles that you find particularly interesting and be prepared to present the information in these articles to your classmates. Be sure to state what you were most intrigued by in each article.

C. Place your articles in the scrapbook provided by your instructor.

Biotechnology: The New Frontier ALT One: Handout 5

Scrapbook Information Sheet

Evaluation/Assessment:

Points will be awarded according to the following rubric.

	0	1	2	3	4	Score
Comprehension of Material	Seem to be reading articles for the first time.	Have read some of the articles.	Read all of the articles but do not understand them.	Read all articles and understand some.	Read all articles and fully understand them.	
Relevancy of Articles	Articles are not from the assigned topic areas.	1 or 2 articles are from assigned topic areas.	Only three articles are from assigned topic areas.	Four articles are from assigned topic areas.	All articles are from assigned topic areas.	
Number of Articles	No articles submitted.	1 or 2 Articles submitted.	3 articles submitted.	4 articles submitted.	5 articles submitted.	
Number of Sources	No acceptable sources used.	Sources are questionable or unclear.	1 Acceptable source used.	2 Acceptable sources used.	3 Acceptable sources used.	
Clarity of Presentation	Presentation makes no sense.	Presentation makes little sense.	Presentation is understood by some.	Presentation is understood by most.	Presentation is understood by all.	

Newsletter Article Handout 6

1. Using the topic assigned by your instructor, find two more articles from the scrapbook that discuss the topic.
2. Select three main points from those articles.
3. Write one or two paragraphs supporting each point.
4. Write one or two paragraphs explaining why this topic is important to those reading the article.
5. Write one introductory paragraph. Explain your topic and why it should be interesting for others to read about it.
6. Write a concluding paragraph.
7. Combine all of your paragraphs into one article. Make sure one paragraph leads smoothly to the next. Rewrite your paragraphs as needed to make the article interesting and easy to understand.
8. Write a headline for your article. Make it something that will catch the attention of your audience.
1. Submit your article to your teacher.