

## **Big Economical and Ecological Concerns Yield Big Opportunities for Florida HS Students**

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**Abstract:** To guide high school students, participating in their second year of Biotechnology education, to develop an understanding of the connections between the high school biotechnology classroom, the real world intuitions of Biotechnology, and emergent pathogens, students will be assigned to digitally record hands on lessons in their high school biotechnology lab, interviews and hands on experiences working with University of Florida research scientists, and representatives of Florida's Biotechnology, Academic, Research, and Industrial institutions; while at the same time documenting and disclosing the significance of their opportunities to the initiative to confront the economical and ecological concern of emerging pathogens in Florida, and the US. Recordings will be creatively edited and disseminated through DVD and/or web.

**Mission Statement:** My goal here is to educate my students, other students, families, and communities about the surmounting concern for the ecological and economical health of the United States and Florida; and to emphasize that this concern has led the federal and state government, and many practicing scientist, to allocate funds and professional support towards encouraging and supporting students, who are willing to train, to gain skills to prepare for career opportunities in the field of biotechnology, and contribute to addressing the concern of emerging pathogens.

**Unit Design:** Students will complete numerous assignment activities, such as filming their own lab experiences, and recording interviews with non-scientist and scientists, as a venue to achieving specific learning outcomes. Using a digital recording camera, students will perform interviews as homework assignments and on field trips. All student work will be submitted electronically so that it can be compiled in intertwined segments of a DVD that could be mass produced and disseminated, and also used on the school website. The assignment activities are described as follows: [permission for use of all recordings will be attained]

### 1. Introducing Biotechnology: (6-10 minutes)

Using the learning strategy of correcting misconceptions, and teacher learner, students will teach the audience what the term Biotechnology means.

a) Students will digitally record other students and adults in the community as they provide an answer to the question "What is biotechnology?"

b) Students will video as the same question is posed to professionals that work in the field of Biotechnology, and ask them to explain one technique or application of a technique used in the field of Biotechnology.

### 2. Calculating the Future with Biotechnology? Students will be assigned to learn about, and create a digital video segment to report on one of the following topics:

How is Biotechnology involved in Agriculture and what can we expect in the future from Agriculture and biotechnology in Florida?

How is Biotechnology involved in the environmental sciences and what can we expect in the future from environmental sciences and biotechnology in Florida?

How is biotechnology involved in pharmacy and what can we expect in the future from pharmacy and biotechnology in Florida?

What are emergent pathogens and what does biotechnology and Florida have to do with emergent pathogens?

### 3. Orienting Florida to Biotechnology

To learn about the workforce need that feeds into the economic feasibility of biotechnology industries students will interview spokespersons for the initiatives that are funding or seeking funding to encourage and build a workforce for Biotechnology in Florida, such as

BioFlorida, Workforce Florida, CERHB, CPET, NSF,

### 4. Research and Biotechnology.

Students will select, or be assigned, to work with, interview in person, and record a research scientist from the University of Florida;

- demonstrating that the techniques students learned in class are used in current research;
- demonstrating that students are invited to learn the applications of Biotechnology techniques through work with scientist at the University of Florida;
- demonstrating that participating in a High School Biotechnology Program provides experience and knowledge that opens up career opportunities for students;
- demonstrating the connection between research and industry through an interview that addresses the source of financial support for the research and the industrial sink that benefits from the research.

### 5. Entering Industrial Biotechnology:

Students will set up an appointment with an industry in Florida to meet with, interview, and film the industry, to present the following information.

- What is the nature of the business?
- Who benefits from the business?
- What employment positions are offered?
- What skills do the positions require?
- What other skills are preferred?

### 6. Media production and design.

Students will train with a media specialist from the University of Florida on downloading and creating digital presentations on a computer so that students can download, edit, and submit all assignments in this unit.

**Qualifications of PI:** PI has 5 years science teaching experience, and is currently teaching Biotechnology for the second year. Having earned a M.Ed degree in secondary education of science, from the University of Florida, this PI earned credit in educational media and has assembled web sites. PI also has earned a BS degree in Horticulture, specializing in Plant Science and Biotechnology, from Delaware Valley College in Pa. PI was involved with developing Florida's three course Industrial Biotechnology Program for high schools and was one of the first schools to work with Florida's Banner Center for Biotechnology, collaborating to bring biotechnology to Florida high school classrooms in the form of a curriculum. PI has submitted testing materials and is currently awaiting notification of award of National Board Certification for teaching.

**Budget:**

4 Media Cards \$25- \$75 each

1 pack rewritable DVD \$10

Bussing students to UF \$120

Substitute for one day \$75

**Donations needed:**

Digital video recording cameras, possible with media cards.

Scientist time with students: including research scientist and media specialist

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Lesson Plan for Activity # 6:

**Title:** **Research and Biotechnology**

**Key Question:** Which techniques learned in high school biotechnology class are utilized in protein research, and how are these applications involved with the initiative to address emergent pathogens? Who financially supports this research and who are the benefactors?

**Science Area:** Biology, Biotechnology, Epidemiology,

**Science Concepts Covered:**

Structure and function of proteins; mutations; x-ray crystallography techniques; antigen antibody relationships

**Grade Level:** 11<sup>th</sup> and 12

**Learning Styles:** Kinesthetic, auditory, visual

**Science Process Skills Used:**

Observation, measurement, gathering data, documentation, reporting, questioning

**Time Estimate:** ~One half school day (2 1/2 hours)

**Vocabulary:** Proteins, x-ray crystallography, antigen, antibody,

**Lesson Summary:** Students will apply their micro-pipetting and serial dilution skills to crystallizing proteins under the supervision of a University of Florida research scientist. Students will then visit the lab where the scientist will explain how x-ray crystallography is used to create computer images of virus protein coats. Students will have a 15 minute sit down interview with the scientist to inquire about the application of the work to emergent pathogens, and the source of funding and benefactors of the research. All experiences and interactions will be digitally recorded by student partners, and submitted as documentation of the assignment.

**Student Learning Objectives:**

The student will be able to perform crystallization of proteins.

The student will be able to explain x-ray crystallography from crystallization and x-ray through computer images.

The students will be able to discuss the applications of x-ray crystallography research to the initiative to address emergent pathogens.

The students will state examples of financial support for protein research as well as industries that are supported by the research.

**Materials:**

Video recording camera and media card, power source

**Supplemental:** Computers, media program

**Background Information:**

Proteins are responsible for many biochemical reactions that occur within living beings and therefore are significant in mans quest for improving life. Scientist all over the world are working on gaining an understanding of proteins, and using biotechnology techniques to synthesize proteins to make life more sustainable. For example, many scientists are studying the protein coat of the Avian Bird Flu Virus, trying to understand how the virus's protein coat bonds to host cells, hoping to create vaccines that will interfere with the bonding of the protein coat to human cells. For these reasons and more, protein manufacturing and research is said to be the cash cow in the biotechnology industry. Students participating in the Biotechnology II course in Florida will study protein assays throughout the year long course, though the concepts of protein bonding may be somewhat abstract.

Viewing the graphic images of proteins, created through crystallization and x-ray techniques, is beneficial to student appreciation and understanding of the concepts of structure and functions of protein interactions. Students will see that x-ray images depict the placement of the amino acids that bond to form the beta sheets, alpha helixes, and loops that give proteins their shapes and allow them to bond to host cells and other molecules.

**Advanced Preparation:**

Field trip preparations:

Permission from principal and parents;

Request for substitute,

Scheduling of UF professionals,

Schedule transportation and parking.

Electronically charge video recording devices.

**Procedure and discussion questions with Time Estimates:**

1. Students will meet at bus pickup at 9:00
2. Arrive at UF at 9:40
3. Walk to lab and use restrooms (10 minutes)
4. Meet with UF crystallography professors, learn about and perform crystallization, while videoing the first part of video. (9:50 -11:15)
5. Instructions on x-ray machinery and computer imaging program, while videoing (11:15-12:15)
6. Interview with Researcher 12:15 -12:30.
7. 12:30 -1:00 Lunch  
[Onto next activity for media]

**Assessment Suggestions:**

Students will be assessed on the explanations they record while working with the professor at UF regarding:

Crystallization procedures.

x-ray crystallography technique

computer imaging

And their interview.