

ANATOMY AND PHYSIOLOGY IN THE BIOTECH ERA

PRINCIPAL INVESTIGATOR'S INFORMATION:

Dr. Claudia Singkornrat
Pompano Beach, FL 33060

ABSTRACT:

Biotechnology is a growing and promising career choice for many students that are interested in science. It is therefore important to expose and prepare these students for possible careers in this exciting field. This can be accomplished during the Anatomy and Physiology class by exploring relevant issues such as human emergent pathogens and genetically modified foods. Students will have the opportunity to apply current biotechnological laboratory techniques and to investigate the latest information on many issues that have an impact on their lives.

MISSION STATEMENT:

The unit aims to expose and prepare students in the fast-growing field of Biotechnology, by exposing them to lab techniques and their applications. Students will explore dangers, preventions, and possible treatments of emergent pathogens and will gain scientific knowledge on the use and dangers of artificial genetic modifications. Students will develop informed and responsible attitudes towards current and future genetic and biotechnological issues.

DESCRIPTION OF THE TEACHING MODULE:

The module will be presented in three sub-sections and spread out over the course, by relating each topic to an organ system affected. All experiments will be simulations and include: and ELISA test, a Microarray, PCR and Electrophoresis. Emergent pathogens presented for the subsections will be HIV and Influenza Viruses. Additionally, students will identify and test for genetically modified foods.

AIDS Module:

The AIDS module will presented during the immune system unit and it has two components: 1) A laboratory exercise using simulated HIV and 2) A lecture/discussion module about the disease.

The lab component:

The students will be the doctors and are presented with the scenario of a person coming in with a fever and a headache. They then have to research five diseases given to them; three of the diseases will fit the symptoms (and are emergent pathogens). In order to determine which disease they are dealing with, Students will be asked to perform an ELISA test and will then find out that the patient is HIV positive.

The lecture component:

Students will be exposed to the pathophysiology of the disease as well as the latest statistics, treatments, and research in the field, as presented by Dr. Robert Lawrence. Students will also have a discussion on how they propose to prevent and reduce the incidence of AIDS.

Influenza Module:

This module will be presented during the Respiratory System unit. It will be introduced with a lecture on the variations of the influenza viruses and the process on producing a flu shot. The students will then be presented with a scenario in which travelers come down with flu-like symptoms. A Microarray simulation provided by Dr. Charles Lawrence will help students identify the flu strain.

Genetically Modified Foods Module:

This module will be presented during the digestive system unit. Students will first perform the following two labs:

- 1) DNA extraction of a strawberry: to understand and visualize how DNA can be obtained
- 2) Detecting Genetically Modified foods: Extraction, Amplification, and Electrophoresis (Carolina Biological Kit)

The labs will be followed up with a discussion on how heavily we should rely on genetically modified foods by evaluating the benefits and the dangers.

EXTENSIONS TO THE UNIT:

I plan to work with FAU and PBCC to look at biotechnology techniques and researches that students may be able to get involved with. I plan to take students to field trips there and to select students to participate in research in the area.

I also will contact local Biotechnology businesses to align guest speakers, to visit, to ask for possible grant money and for the possibility of students collaborating with them.

EXPECTED OUTCOMES:

Students:

1. Understand and perform genetic engineering practices such as PCR, electrophoresis, and DNA extraction and identification.
2. Infer which technique is best for different situations
3. Obtain an insight of the genetic engineering field and possible college majors
4. Increase their passion in science by making the connections of materials taught in class and real life applications
5. Understand and evaluate pertinent, current information on emerging pathogens

PRINCIPAL INVESTIGATOR'S EXPERIENCE:

- ❖ Science Teacher for 7 years
- ❖ Background in Microbiology
- ❖ Participant in the ICORE program
- ❖ Health related knowledge gained by practicing Chiropractic for over 10 years

LITERATURE CITED:

Daugherty, Ellyn. Biotechnology Science for the New Millennium. Minnesota: EMC Publishing, 2007

Campbell, Neil & Reese, Jane. AP EDITION BIOLOGY. California: Pearson Education Inc., 2005

Anthony E. Fiore, MD¹, et al. Prevention and Control of Influenza, 2008

<<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e717a1.htm>>

BUDGET:

Lab Kit: Detecting Genetically Modified Food (Carolina Biological) :	\$171.00
Elisa Test Kit (Carolina Biological)	\$ 89.00
Approximate shipping and handling cost (Quoted by Carolina Biological)	\$ 26.95
Funds for copies, strawberries extraction supplies, Agar,:	\$ 40.00

TOTAL: **\$326.95**

POMPANO BEACH HIGH SCHOOL

Lesson Plan for

Anatomy and Physiology in the Biotech Era

By Dr. Claudia Singkornrat

Subject: Anatomy and Physiology Honors

Grade Level: 10 –12th Grade

ADDRESSED FLORIDA STATE STANDARDS :

SC912.N.1.1, SC912.N.1.3, SC912.N.1.4, SC912.N.1.5, SC912.N.1.6, SC912.N.1.7
SC912.N. 2.1, SC912.N.2.2, SC912.N.2.4, SC912.N.3.5, SC912.N.4.1, SC912.N.4.2
SC912.P.8.5, SC912.P.8.8, SC912.P.12.13, SC912.P.12.13, SC912.L.14.2,
SC912.L.14.3, SC912.L.14.4, SC912.L.14.6, SC912.L.14.16, SC912.L.14.21,
SC912.L.14.42, SC912.L.14.45, SC912.L.14.46, SC912.L.14.52

AIDS MODULE:

1. KEY CONCEPTS:

- a. HIV is a serious emergent pathogen, which leads to many concerns in health, society and science.
- b. Biotechnology is a critical tool in the diagnosis of many diseases.

2. OBJECTIVES:

- a. To understand the mode of transmission, disease progression, and prevention of HIV.
- b. To mimic a diagnostic test and to determine the presence or absence of the HIV virus.
- c. To brainstorm ways of preventing and treating the disease

3. PRE-PLANING:

- a. Order an Elisa Kit from one of the suppliers (such as the Carolina Biological AIDS Simutest Kit.)
- b. Introduce how HIV affects the immune system, as well as the latest facts and statistics of HIV infections.

4. ANTICIPATORY SET:

- a. Students will be stimulated with a scenario in which they will be the doctors who see three patients with similar symptoms. They then will have to determine which of the patients is HIV positive.

5. PROCEDURE:

- a. HIV will be introduced during the immune system unit, once students understand white blood cells and their functions. The introduction includes the latest statistical information, which can be obtained from the CDC or

from the information presented by Dr. Robert Lawrence at the ICORE workshop.

- b. The class will then explore how the presence of HIV can be detected. The concepts of immunoassays will be presented to the class. The students then will perform the ELISA test according to the instructions of the kit used. The kit can be slightly modified, by presenting the scenario and having the positive ELISA test correspond to the patient who is the AIDS patient.
- c. Following the experiment, have a class discussion on the best ways to increase HIV awareness and prevention. If time permits, a discussion of the financial impact on families and society due to HIV allows the student to link the disease to economics and sociology.

6. CLOSURE AND EVALUATION:

- a. Test the students on the knowledge of HIV and of the ELISA technique
- b. Have students write a reflection on how their views on the disease changed.
- c. Challenge the students to infer how the ELISA can be used for other diseases such as allergies.

INFLUENZA MODULE:

1. KEY CONCEPTS:

- a. Using a microarray to diagnose disease
- b. Methods used by the CDC to identify strains for the Flu vaccine
- c. Understanding the signs, symptoms, dangers, prevention and history of influenza

2. OBJECTIVES:

- a. Perform a microarray to identify a simulated disease
- b. Reflect on the importance of genetic mutation and variation in disease processes.
- c. Reflect on the difficulty of producing a vaccine with the correct strains of disease.

3. PRE-PLANNING:

- a. Discuss influenza during the respiratory system.
- b. Obtain a microarray simulation Kit produced by Dr. Charles Lawrence

4. ANTICIPATORY SET

Have students consider the following statements:

- a) Why do some people get the flu even though they were vaccinated against it?
- b) Why do you think was last year's (2007) vaccine ineffective?

5. PROCEDURE

- a. Have students research the history of influenza
- b. Present
 - a) Signs and symptoms of the disease
 - b) Risks of the disease
 - c) Prevention and treatment
- c. Have students perform the microarray simulation.

6. CLOSURE AND EVALUATION

- a. Pose the following question for a debate: Who should get the flu vaccine? Consider risks of the disease and the vaccine, economical issues, and ethical issues.
- b. Design an assessment to test the knowledge gained on microarray usage, and influenza facts

GENETICALLY MODIFIED FOODS MODULE

1. KEY CONCEPTS:

- a. Using extraction, amplification and electrophoresis to identify genetic sequences
- b. Understanding the benefits, dangers and misconceptions of Genetically Modified Foods

2. OBJECTIVES:

- a. To familiarize and apply current biotechnology techniques (DNA extraction, amplification, electrophoresis).
- b. To apply biotechnology to a real-life situation that students can relate to.
- c. To reflect on the benefits, dangers and misconceptions of genetically modified foods.

3. PRE-PLANNING:

- a. Order a kit for the extraction, amplification, and electrophoresis of genetically modified foods from a supplier (such as Carolina Biological)
- b. Teach
 - i. The anatomy and physiology of the digestive system
 - ii. The importance of the different nutrient types for the body.

4. ANTICIPATORY SET

- a. Pose the question: Should we eat genetically modified foods?
- b. Find a college or a biotechnology industry that can help you with the equipment to run the PCR

5. PROCEDURE:

- a. Students research which foods are currently genetically modified.
- b. Students test for genetically modified foods with the lab kit, by following the instructions of the kit.

- c. Students research the benefits, dangers and misconceptions of genetically modified foods.

6. CLOSURE AND EVALUATION

- a. Students write a reflection on the benefits, dangers and misconceptions of genetically modified foods
- b. Design a test to assess student's knowledge of DNA extraction, amplification, and electrophoresis.

Resources:

1. Daugherty, Ellyn. Biotechnology Science for the New Millennium. Minnesota: EMC Publishing, 2007
2. Campbell, Neil & Reese, Jane. AP EDITION BIOLOGY. California: Pearson Education Inc., 2005
3. Anthony E. Fiore, MD¹, et al. Prevention and Control of Influenza, 2008
<<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr57e717a1.htm>>
4. CDC website for information on HIV and Influenza
5. Marieb, Elaine. Essentials of Human Anatomy and Physiology, Eight Edition California: Pearson Education Inc., 2006