

Introducing Emerging Pathogens into the General Biology Curriculum

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Abstract:

Part of scientific inquiry is to engage student interest before exploring and investigating a concept. This proposal addresses the use of emerging pathogens as a topic to draw students into each three units within the biology curriculum. Once student engagement is achieved in a unit, the goal is to incorporate current biotechnology techniques and skills into the area of investigation. After investigation, students will be asked to address the relevance and application of their new knowledge.

Due to the fact that the issue of emerging pathogens is a natural fit within the Biology curriculum at any level, concepts relating to emerging pathogens are not exclusive to Advanced classes and can be easily introduced into General Biology classes. The science of emerging pathogens will be used to give each unit of Biology a real-world application. This will be done by providing General Biology students with a scenario that they will investigate using biotechnology simulations and current methods of virus detection with Immunostrips.

Mission Statement:

My mission is to engage students before each Biology unit by using current research scenarios involving emerging pathogens. Students will use the background information they encounter during engagement to investigate Biological topics using biotechnology methods and simulations.

Description of teaching unit or module(s), including expected outcomes:

Description:

A scenario relating to a current issue within the field of emerging pathogens will be used to draw students into a unit on Cellular Functions, Ecology, and the Human Immune System. Each Biology Unit will have a short, specific scenario that has been written for it that involves emerging pathogens and places the students in the role of investigator. The method of investigation will involve using activities, simulations, diagrams, and biotechnology at an introductory level. For example, students will extract DNA but complete a simulation of electrophoresis.

Expected Outcomes:

- Students will connect Cellular Functions, Ecology, and the Immune System to an issue that is relevant to them regarding emerging pathogens.
- Students will learn vocabulary and curriculum objectives through investigation related to the scenario.
- Students will learn Biotechnology methods through a series of simulations.
- Students will experience cutting edge methods of virus detection through the use of Immunostrips from Agdia, Inc.
- Students will make global connections about the issue of emerging pathogens and discuss future issues.

Expertise and Contributions of the Principal Instructor:

The principal investigator was the sole developer of this action proposal. She received a Bachelors of Science in Biology from the University of South Florida and a Masters in Science Education from the University of Central Florida. After working in the Camping and Recreation field for 10 years, the principal investigator entered into the teaching profession at Mount Dora High School, located in Mount Dora, Florida. She began by teaching General Biology and Earth Science for two years, and advanced to presently teaching Advanced

Placement Biology and General Biology. She acts as the Science Department Chair, and also coaches the Mount Dora High School Hi-Q team.

To add to her knowledge in the area of Science teaching, she attended the Florida Association of Science Teachers, otherwise known as FAST, conference in October of 2007, and 2008. In 2008 she was accepted into the NSTA, New Science Teacher Academy as a 2008 Fellow. This allowed the investigator to attend online courses related to the use of scientific articles in the classroom and virtual labs, along with using the method of scientific inquiry in the classroom. Upon Completion as a Fellow, the principle investigator attended the NSTA conference in New Orleans, 2009.

She is certified in the areas of Biology 6-12, and Earth Space Science 6-12, and is English to Speakers of Other Language, ESOL endorsed. In order to expand knowledge in the area of Biotechnology, the PI has since completed a two week ICORE course at the University of Florida on Emerging Pathogens in June of 2009.

Literature cited:

Miller & Levine. Biology (Copyright 2006) by Prentice-Hall. Adopted 2007.

Jones, Judith D. "Biology Students and the Giant Plant Cell" East Chapel Hill High School
<http://teachersnetwork.org/ntol/lessons/plantcell/index.htm>

Concept to Classroom: Workshop: Inquiry-based Learning
<http://www.thirteen.org/edonline/concept2class/inquiry/index.html>

Mystery Diagnosis, Discovery Health <http://health.discovery.com/fansites/mystery-diagnosis/mystery-diagnosis.html>

Budget and budget justification:

Agdia, Inc. Tobacco Mosaic Virus Immunostrip ISK 57400/0025 Set of 25 = \$105.00

To perform the Giant Microbes for Bacteria/Viruses introductory lesson: (2 collections at \$39.95 each, 1 at \$14.95 each) = total cost \$94.85

Theme: Emerging Pathogens

Lesson Title	The Immune System and Disease
Grade Span	9-12
Content Emphasis	Science
Targeted Benchmark(s)	SC.912.L.14.52: Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics. SC.912.L.16.7: Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology.
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School	Mount Dora High School

Lesson Preparation

Learning goals:

The Student will:

1. Gain knowledge about the variety of disease causing organisms and possible hosts.
2. Learn in-depth about a specific pathogen, disease, and treatment.
3. Explore how the body responds to infection.
4. Learn how to detect infection from bacteria or viruses.

Estimated time: 5, 90 minute periods

Day 1 = Infection scenario and introduction exercise (Microbe Matching Game)

Day 2 = Research of Microbe (characteristics, disease, treatment)

Day 3 = Presentation of Research

Day 4 = Microassay simulation and discussion of technique

Day 5 = Essay Assessment

Materials/Resources: Please list any materials or resources related to this lesson.

Giant Microbes

Microbe Matching Game Printouts (per class)

Internet Access

Microassay infection simulation (lab groups of 3 students)

Teacher Preparation: What do you need to do to prepare for this lesson?

Hang Giant Microbes

Make copies of Microbe Matching Game

Request Computer Lab for Day 2

Create Assessment

Lesson Procedure and Evaluation

Introduction: Describe how you will make connections to prior knowledge and experiences and how you will uncover misconceptions.

Using the KWL strategy, students will brainstorm as a class on what they know about pathogens. This will pave the way for a more in-depth introduction to a specific microbe and the disease it causes through the Matching Game. After spending the week on research and simulation, we will close by revisiting the KWL chart and correcting any misconceptions. Students will also be asked to add to the chart about what they learned about pathogens that they had not already known.

Exploration: Describe in detail the activity or investigation the students will be engaged in and how you will facilitate the inquiry process to lead to student-developed conclusions.

Day 1 = Students will brainstorm as a class about what they already know concerning the topic of pathogens (bacteria/viruses). We will write the information on a paper chart that will stay present in the classroom for the week. Students will then be given either a printout of a description of a microbe, or a description of a disease caused by a microbe. Students will then have to find their matching microbe and/or disease, and match it to the Giant Microbes hanging around the classroom. Students will then be assigned their microbe for investigation and given a rubric on how they will present their findings to the class.

Day 2 = Students will be given access to the Computer Lab at school to research their assigned microbe, including characteristics, history of the pathogen, disease it causes, and treatment.

Day 3 = Presentation of Research – Students are asked to review the grading rubric before they present. Students in the audience are responsible for creating a chart listing the presentation findings.

Day 4 = Class will watch 5 minute clip of Immunofluorescent Assay and discuss application of this technology for society. Students will be divided into lab groups of 3 students per group and perform the Microassay simulation. Students will write up their procedure and results in Lab Report format.

Day 5 = Students will hand in their Lab Reports from the Microassay simulation. As a class we will revisit the KWL chart and look for misconceptions that we had at the beginning of the week. We will also add to the chart what we learned about pathogens and the methods used to investigate infection. Students will be given a 5 question short answer quiz to assess specific knowledge about microbes, infection, relation to society, investigating infection, future applications.

Assessment: Describe how student knowledge is being assessed at the appropriate cognitive level for the targeted benchmarks.

Assessment per each student goal:

1. Students will be asked to list and describe 5 microbes and disease they cause, following student presentations.
2. Students will be graded on the research they performed on a specific microbe and its' disease as described in a rubric available to them.
3. Students will be asked to write a lab report on their microassay simulation and graded by the lab report rubric available to them.