

# **WHO, WHAT, WHERE, WHEN, WHY, HOW AND FOR HOW FAR AND LONG?**

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## **Abstract**

The goal in implementing this action plan is to introduce the concept of pathogens and the damage they can cause to humans, plants or animals along with potential impact on the community in which they are full blown. Through various teaching methods; lectures, videos, reading of short stories and laboratory activities the students will discover the forms a pathogen can be in and how they are transmitted. Each student will trace a given pathogen from its origin to the United States and finally to Florida, and determine concerns for this disease. Part of the research will be the treatment for or containment of the pathogen and to determine what has been done through time to alter the pathogen in hopes of killing it or changing it to be less harmful.

The students will conduct a laboratory investigation to visualize how quickly one infected person is able to cause the disease to show up in a population between 25 and 30 items.

The students will be taught the proper procedure for using a pipette and they will run at least one gel electrophoresis or an ELISA along with various microarrays so they have a feel for how information is gathered on these pathogens.

## **Rational**

Laboratory investigations which include the use of scientific inquiry, research, measurement, problem solving, laboratory apparatus and technologies, experimental procedures, and safety procedures are an integral part of the Physical Science course. For this part of the lesson, I would check out a locker so I could teach the students how to properly use a pipette, how to run a gel electrophoresis and/or an ELISA test along with a microarray and the type of data each test is capable of producing. In doing research for their presentation on pathogens, the students will learn to evaluate sources they use and interpret graphs and maps in showing the spread of their specific pathogen and the numbers of people, animals or plants infected. In giving oral presentations to their class, the students will feel more comfortable in public speaking and if they generate a power point, they will produce a product that is in the realm of professional standards. The writing of a research paper will incorporate English state standards and state math standards will be addressed in their presentation of data and in the advertisement for their specific pathogen.

## **Description of Teaching Unit Including Expected Outcomes**

Even though these lessons plans are written for a Physical Science class, the activities will also covered standards from Algebra I and 10<sup>th</sup> grade English.

- 1) A simulation using liquids, representing a pathogen, will be played out in class so students can see how quickly one infected “item” whether it is a person, plant or animal, is capable of passing the “infection” onto a population. This activity will cover all type of learning styles. Students will track who they have made contact with, so the class can work backwards to determine (if possible) who introduced the disease into the population.
- 2) Readings from The Little Book of Pandemics by Dr. Peter Moore.
- 3) Readings from What You Need To Know About Infectious Diseases by the National Academies.
- 4) The matching question and answers regarding microbes will be used in the classroom so after reading excerpts from The Little Book of Pandemics, the students realize how different pathogens are in their shape and sizes.
- 5) Each student will be given the name of a pathogen to research and determine the following:
  - a. Is the pathogen a one or two host mechanism, and how are the hosts effected by carrying the pathogen, if they are just a carrier?
  - b. Where the pathogen originated and how was it transported to the US and more specifically can they determine how it arrived in Florida and when it was first noticed or recorded?
  - c. Locate and/or generate graphs illustrating the range of years and number of cases.
  - d. Locate and/or generate maps showing how the pathogen arrived to the US and then into Florida.
  - e. Explain how human activities, land use and weather patterns played a role in the spread of this pathogen.
  - f. What are the symptoms and course of the disease and its mortality rate?
  - g. How can the disease be treated, controlled and/or eliminated?
  - h. How was the treatment determined?
  - i. If this pathogen has caused an epidemic or pandemic. If so, when, where and for how long did it or these occur?
  - j. Is there the potential for this pathogen to cause an epidemic or pandemic? Why or why not?
  - k. Bibliography and evaluation of sources
- 6) 10 to 12 minute oral presentation to class on pathogen.
- 7) Students will generate a poster advertisement regarding their pathogen. These posters will be put on display (after teacher review for accuracy) in the library so the remainder of the student body can be made aware of current pathogens which could become a part of their life.

### **Materials Needed**

Disease spreading simulation

One test tube per student

Water in all but one test tube

One test tube per class of hydrogen peroxide (this will be the infected person)

Dropper bottle of bleach to use to test at end of simulation if someone is infected

Paper/Oral Presentation/Poster

Students need a list of diseases to choose one from

Access to and time to use resources found in the media center

Hands on experience with micro arrays and micro pipetting will depend on time and if the materials are available. This is a definite asset to the unit providing students will hands on experiences as if they are in the actual lab.

### **Potential Diseases for Students to Research**

#### **Pathogens Used**

- 1) Anthracnose
- 2) Chagas disease
- 3) Citrus Greening
- 4) Dengue Fever
- 5) Ehrlichiosis
- 6) Fibropapilloma
- 7) Filariasis
- 8) Florida torreyia mycosis
- 9) Foot and Mouth Disease
- 10) Greasy Spot Disease
- 11) Labyrinthula zosterae
- 12) Leathal Yellowing of Palm Trees
- 13) Leishmaniasis
- 14) Lyme Disease
- 15) Malaria
- 16) Psittacosis
- 17) Rift Valley Fever
- 18) Spring viremia of carp
- 19) St. Louis encephalitis
- 20) Toxoplasmosis
- 21) URTD in gopher tortoise
- 22) Verticillium Wilt
- 23) Vibrio cholera
- 24) Vibrio vulnificus
- 25) West Nile fever
- 26) Whitmore's disease
- 27) Yellow Mold of Peanuts

### **Student Learning Objectives**

All of the following learning objectives will be assessed through the student's written research paper, oral presentation and the poster they construct.

LA.910.2.2.3: The student will organize information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, comparing, contrasting, or outlining);

LA.910.4.2.2: The student will record information and ideas from primary and/or secondary sources accurately and coherently, noting the validity and reliability of these sources and attributing sources of information;

SC.912.L.15.2: Discuss the use of molecular clocks to estimate how long ago various groups of organisms diverged evolutionarily from one another.

SC.912.N.1.1: Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

pose questions about the natural world,

conduct systematic observations,

examine books and other sources of information to see what is already known,

review what is known in light of empirical evidence,

plan investigations,

use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),

pose answers, explanations, or descriptions of events,

generate explanations that explicate or describe natural phenomena (inferences),

use appropriate evidence and reasoning to justify these explanations to others,

communicate results of scientific investigations, and

evaluate the merits of the explanations produced by others

SC.912.N.1.3: Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented.

SC.912.N.1.4: Identify sources of information and assess their reliability according to the strict standards of scientific investigation.

SC.912.N.1.6: Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

SC.912.N.1.7: Recognize the role of creativity in constructing scientific questions, methods and explanations.

SC.912.N.3.5: Describe the function of models in science, and identify the wide range of models used in science.

SC.912.N.4.1: Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform society's decision making.

#### **Data Collection techniques and/or Student Assessment**

- 1) A pre and posttest will be given on the basics of pathogens, biotechnology equipment and careers related to biotechnology.
- 2) Student's research papers on their specific pathogens will be graded according to a rubric.
- 3) Student's oral presentation on their specific pathogens will be graded according to a rubric.
- 4) Student's advertisement poster for their specific pathogen will be graded according to a rubric.

Student's will not be assessed on the specifics of other diseases presented in class, but rather on the concepts of how diseases are spread from one location, time for this to occur, possible outcome and what society can do to prevent the spread of such diseases. The student's test will consist of math problems calculating rate of movement of disease and the ability to read and interpret a variety of graphs relating to the data presented by their peers.

#### **Use of Equipment and/or UF visit**

- 1) Checking out of lockers from CPET.
- 2) Checking out equipment from Dr. Lawrence.
- 3) Potential visit from UF CPET staff on day of pathogen presentations depending on time frame.
- 4) It is possible that several science research students will travel with me to UF for testing during their science fair projects

#### **ICORE Summer Institute Elements Specifically Included**

- 1) How to properly use a micropipette.
- 2) How to run and interpret a gel electrophoresis, ELISA and Microarray
- 3) Close to some aspect of 95% of the speaker's presentations have been included or serve as background information for me to be able to present this unit to my students.
- 4) Potential careers in the biotechnology field.

**Literature Cited**

Belcher R. 2011 June. Micropipette by Coordinates Activity. University of Florida Center for Pre-collegiate Education and Training Summer Institute.

Connolly, R.C. 2011 June 17. Historical and Emerging Mosquito-borne Pathogens in Florida. University of Florida Center for Pre-collegiate Education and Training Summer Institute.

Drexler. M. What you Need to Know About Infectious Disease. National Academy of Sciences 2011.

Green, L. 2011 June 21. ELISA Techniques. University of Florida Center for Pre-collegiate Education and Training Summer Institute.

Mandell. T. 2011 June 14. Biotechnology Curriculum and Careers. University of Florida Center for Pre-collegiate Education and Training Summer Institute.

Moore. Peter. The Little Book of Pandemics: 50 of the World’s Most Virulent Plagues and Infectious Diseases. Sterling Publishing 2009.

Morris, G. 2011 June 12. Emerging Pathogens and Pandemics: Things that Go Bump in the Night. University of Florida Center for Pre-collegiate Education and Training Summer Institute.

<http://www.needtoknow.nas.edu/infectiousdisease/>

**Budget and Justification**

Giant Microbes with Q & A	No cost	On Loan from CPET
Pipetting Station	No Cost	On Loan from CPET
Intro to Gel Electrophoresis	No Cost	On Loan from CPET
<u>The Little Book of Pandemics:</u>	25 copies x 10.00 Could be less per book	\$250.00
MicroArrays	No Cost	On Loan from Dr. Lawrence
Simulated ELISA runs	No Cost	On Loan from Dr. Lawrence\
<u>What You Need To Know About Infectious Disease</u>	May be of no cost	From National Academies

Oral Presentation Rubric

**Presentation Rubric**

Evaluating Student Presentations					
Developed by Information Technology Evaluation Services, NC Department of Public Instruction					
	1	2	3	4	Total
<b>Organization</b>	Audience cannot understand presentation because there is no sequence of information.	Audience has difficulty following presentation because student jumps around.	Student presents information in logical sequence which audience can follow.	Student presents information in logical, interesting sequence which audience can follow.	

<b>Subject Knowledge</b>	Student does not have grasp of information; student cannot answer questions about subject.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student is at ease with expected answers to all questions, but fails to elaborate.	Student demonstrates full knowledge (more than required) by answering all class questions with explanations and elaboration.	
<b>Graphics</b>	Student uses superfluous graphics or no graphics	Student occasionally uses graphics that rarely support text and presentation.	Student's graphics relate to text and presentation.	Student's graphics explain and reinforce screen text and presentation.	
<b>Mechanics</b>	Student's presentation has four or more spelling errors and/or grammatical errors.	Presentation has three misspellings and/or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has no misspellings or grammatical errors.	
<b>Eye Contact</b>	Student reads all of report with no eye contact.	Student occasionally uses eye contact, but still reads most of report.	Student maintains eye contact most of the time but frequently returns to notes.	Student maintains eye contact with audience, seldom returning to notes.	
<b>Elocution</b>	Student mumbles, incorrectly pronounces terms, and speaks too quietly for students in the back of class to hear.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	
				<b>Total Points:</b>	

Research Paper Rubric

<b>Criteria</b>	<b>10</b>	<b>8</b>	<b>5</b>	<b>3</b>
<b>Purpose</b>	The writer's central purpose or argument is readily apparent to the reader.	The writing has a clear purpose or argument, but may sometimes digress from it.	The central purpose or argument is not consistently clear throughout the paper.	The purpose or argument is generally unclear.
<b>Content</b>	Balanced presentation of relevant and legitimate	Information provides reasonable support for a central	Information supports a central purpose or argument at times. Analysis is basic or	Central purpose or argument is not clearly identified. Analysis is vague or

	information that clearly supports a central purpose or argument and shows a thoughtful, in-depth analysis of a significant topic. Reader gains important insights.	purpose or argument and displays evidence of a basic analysis of a significant topic. Reader gains some insights.	general. Reader gains few insights.	not evident. Reader is confused or may be misinformed.
<b>Organization</b>	The ideas are arranged logically to support the purpose or argument. They flow smoothly from one to another and are clearly linked to each other. The reader can follow the line of reasoning.	The ideas are arranged logically to support the central purpose or argument. They are usually clearly linked to each other. For the most part, the reader can follow the line of reasoning.	In general, the writing is arranged logically, although occasionally ideas fail to make sense together. The reader is fairly clear about what writer intends.	The writing is not logically organized. Frequently, ideas fail to make sense together. The reader cannot identify a line of reasoning and loses interest.
<b>Feel</b>	The writing is compelling. It hooks the reader and sustains interest throughout.	The writing is generally engaging, but has some dry spots. In general, it is focused and keeps the reader's attention.	The writing is dull and unengaging. Though the paper has some interesting parts, the reader finds it difficult to maintain interest.	The writing has little personality. The reader quickly loses interest and stops reading.
<b>Tone</b>	The tone is consistently professional and appropriate for an academic research paper.	The tone is generally professional. For the most part, it is appropriate for an academic research paper.	The tone is not consistently professional or appropriate for an academic research paper.	The tone is unprofessional. It is not appropriate for an academic research paper.
<b>Word Choice</b>	Word choice is consistently precise and accurate.	Word choice is generally good. The writer often goes beyond the generic word to find one more precise and effective.	Word choice is merely adequate, and the range of words is limited. Some words are used inappropriately.	Many words are used inappropriately, confusing the reader.
<b>Grammar, Spelling, Writing Mechanics (punctuation, italics, capitalization, etc.)</b>	The writing is free or almost free of errors.	There are occasional errors, but they don't represent a major distraction or	The writing has many errors, and the reader is distracted by them.	There are so many errors that meaning is obscured. The reader is confused and stops reading.

		obscure meaning.		
<b>Length</b>	Paper is the number of pages specified in the assignment.			Paper has more or fewer pages than specified in the assignment.
<b>Use of References</b>	Compelling evidence from professionally legitimate sources is given to support claims. Attribution is clear and fairly represented.	Professionally legitimate sources that support claims are generally present and attribution is, for the most part, clear and fairly represented.	Although attributions are occasionally given, many statements seem unsubstantiated. The reader is confused about the source of information and ideas.	References are seldom cited to support statements.
<b>Quality of References</b>	References are primarily peer-reviewed professional journals or other approved sources (e.g., government documents, etc.). The reader is confident that the information and ideas can be trusted.	Although most of the references are professionally legitimate, a few are questionable (e.g., trade books, internet sources, popular magazines, ...). The reader is uncertain of the reliability of some of the sources.	Most of the references are from sources that are not peer-reviewed and have uncertain reliability. The reader doubts the accuracy of much of the material presented.	There are virtually no sources that are professionally reliable. The reader seriously doubts the value of the material and stops reading.

Poster Rubric

	Exceeds Expectations	Meets Expectations	Does Not Meet Expectations
<b>Points Earned</b>	<b>10</b>	<b>6</b>	<b>1</b>
<b>Colors and Patterns</b>	Enhance readability	Support readability	Detract from readability
<b>Layout</b>	Creatively enhances information	Balanced, uncluttered, adequate white space	Not balanced, cluttered, insufficient white space

<b>Graphics</b>	All graphics are engaging, enhance text	Graphics enhance text	Graphics do not enhance text
<b>Titles and Subtitles</b>	All titles and subtitles are clear, enhance readability	Most titles and subtitles are clear, enhance readability	Few or no titles or subtitles to clarify text
<b>Text Size and Color</b>	All text is clear and readable; a few changes in size and color enhance understanding	Text is clear and readable; changes in size and color enhance understanding	Some text is clear and readable; frequent changes in size and color do not enhance understanding
<b>Writing</b>	Well written and organized, clear, easy to follow	Adequately written and organized, clear, reasonably easy to follow	Poorly written and organized, unclear, hard to follow
<b>Quality of Information</b>	Product description is clear, complete, concise	Product description is mostly clear, could be a little more concise	Product description is not clear, incomplete, not concise
<b>Grammar and Spelling</b>	No grammar or spelling errors	One grammar or spelling error	Many grammar and spelling errors