

Title: An Exploration of Emerging Pathogens

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Abstract: This action proposal will take AP Chemistry students who have completed 2 years of chemistry and introduce them to a topic that they know very little about. It is made to be an introduction to emerging pathogens and to spark an interest in a possible direction to continue to study in the next few years. It will include five 47-minute class periods, with an introduction to bacteria and viruses in humans and animals as well as plant pathogens. There will be some hands-on labs as well as a presentation at the end of a recent article that they have found on an emerging pathogen.

Rationale: Most of my AP Chemistry students either want to be doctors or after two years of Chemistry don't want to do science at all. With chemistry the standards that we teach can seem very removed from real world application. This module is a chance to present a topic that is relevant to current events and shows them a different route other than medical doctor that they can take. After AP Chemistry my students usually go to AP Physics or AP Biology. If they go to AP Biology this can be an introduction to some of the topics. Even if they are not going toward biology this is a good example of how science is being used in other fields of study out side of just being a medical doctor or a scientist in a lab.

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

Day 1: PowerPoint introduction to emerging pathogens with some attention-grabbing pictures and news stories. This will include lots of vocabulary that will be new to Chemistry students such as: transmission, virulence factors, epidemic, pandemic, vector reservoir and many more. A general overview of the plans for the week as well as an explanation of their final project presentation and copies of the rubric for the grading will be handed out. **Students will be able to** give a general description of several definitions that have to do with emerging pathogens. Understanding and interest will be assessed by an online quiz/survey to be completed before they return to class the next day.

Day 2: Bacteria PowerPoint including virulence factors, antibiotic resistance, history of shigella, gene transfer, mutation rates, and vector reservoir. Students will get their first opportunity to grow bacteria and test for antibiotic resistance by growing E. coli in a liquid media and adding different antibiotics to separate vials. After a 24 hour incubation period students will qualitatively determine if the bacteria is resistant to the antibiotics by checking for cloudiness of the solution. This can be tied back to their spectrometry lab by explaining that that is one way of turning our qualitative data into quantitative data and is how it is done in a research lab. Part one of the Ebola Epidemic will be started with students split into groups to look on the CDC webpage to find information for their specific topic that will be presented in class the next day. **Students should be able to** understand what antibiotic resistance is and have at least one connection from our AP Chemistry lab to a real world application in research.

Day 3: Students will do a 1 minute presentation on their specific topic on Ebola. Next the students will do a fluid swap with three other students. Cups will be identified by case numbers to relate to the next activity. Before results for the fluid swap are given students will split into groups to do Part 3 where they track an epidemic using case number cards and placing the cases on the map to try to

determine patient zero and how the virus spread out of the village. After each group has discussed and determined who patient zero is and how the virus spread, we will come back as a group and discuss their results. They will then get their fluid swap cups tested and try to determine patient zero among themselves. Patient zero should be the same case number as patient zero in the geographical analysis. **Students should be able to** understand how the virus is spread and how geographical information and patient surveys is used to determine where the source of the virus started.

Day 4: Plant pathogens will be presented in a PowerPoint including information on: bacterial, virus, fungi. symptoms pictures, vectors, treatments, and genetic engineering. After a general overview more detail will go into strawberry and orange disease since it is so impactful on my students lives. We will end with a discussion on genetic engineering. **Students will be able to** use their new understanding of plant pathogens to carry on a discussion and try to clear up misconceptions or confusion that they might have about genetic engineering.

Day 5: Students will do a two-minute presentation on a recent news article or research article from the past year. They will be graded by the other students according to the rubric provided on Day 1. **Students should be able to** research an emerging pathogen story and identify the type of pathogen, how it is transferred, risk factors, vectors, hosts, and environment and other key components that were presented as being important and related to our discussion on emerging pathogens.

Data Collection/Student Assessment:

1. Students will be given an exit ticket where they will be asked to write one example of a bacterial pathogen and one example of a disease caused by a bacterial pathogen along with one example of a viral pathogen along and one example of a disease caused by a viral pathogen.
2. Students will report the antibiotic their bacteria is resist to after completing the laboratory experiment.
3. Students will complete and turn in the CDC website activity. Students will answer the questions upon completing the "Tracking an Epidemic" activity and will present their finding to the class. Groups will be allowed to have a discussion in case they do not agree on who patient zero was.
4. Students will be given an exit ticket where they will be asked to write two interesting things they learned and two questions they still have.
5. Students will submit their research and students will submit the completed rubric for each presentation.
6. Students will complete an online survey as a reflection of the week.

Item/vendor/cost: 1x Ampicillin Solution, 4 mL \$6.25 Item # 216858 Carolina

1x Kanamycin Solution, 4 mL \$6.25 Item #216862 Carolina

1x Luria Broth, 50-mL bottles, Pack of 5 Item #216650 \$26.50 Carolina

8x MM294/pAMP Slant Culture Item # 211540 \$13.50 Carolina

8x MM294/pKAN Slant Culture Item #211550 \$14.75 Carolina

5x Inoculating Needles, Sterile, Disposable, Pack 30 Item # 703046 \$7.45 Carolina

3x SpectraTube™ Centrifuge Tubes, 15 mL, Pack of 50 Item # 215098 \$32.95 Carolina

Locker: Vortex: 0-3000 RPM vortex for mixing solutions

Pipetting Stations: 1-20 µl and a 20-200 µl micropipette for each lab group

Total: \$401.10 for two applicants

CATALySES elements specifically included (UF Connection):

Antibiotic Resistant Bacteria Lab

Ebola Epidemic Lab

Topics from Plant Pathogen Day lecture information

Topics from Dr. Morris "So What is an Emerging Pathogen"

Topics from Dr. Venugopalan "Staying Ahead of the Race Against Antibiotic Resistance"

Topics from Dr. Maurelli "A Brief History of Shigella"

Topics from Dr. Barbey "Genetic Engineering in Crops"