Can Paper Save the World?
Finding answers to an impending global health crisis.

Connections to the Next Generation Science Standards

Practice Elements:
- Develop a model to generate data to support explanations, predict phenomena, analyze systems, & solve problems.
- Plan & carry out an investigation.

Crosscutting Concept Elements:
- Patterns
- Cause & Effect

Disciplinary Core Idea:
- HS-LS1-1
- HS-LS1-3

Lesson Summary

It’s estimated by 2050 the world will need to feed 9 billion people (National Geographic, 2016). Feeding people isn’t the only issue, can we keep them healthy? Currently there exists a global disparity in healthcare and it is sure to get worse.

Right now, 2.3 million people do not have access to the level of healthcare necessary for their health and survival. Poor populations are most affected, with only 5 countries being the most afflicted: India, Nigeria, Pakistan, Ethiopia, and the Democratic Republic of Congo. These five countries also represent 6 million child deaths from health complications yearly. (Humanium.org, 2016)

What if there were a way to close the gap? What if you could create accessibility for reliable tests for the 1/3 of the world without access? As it turns out for people infected with viruses, there is a way. By utilizing the unique proteins found on viruses, a special test can be done to diagnose infection.

What if students could take part in this process? If by designing an experiment using a viral substitute they could help streamline a quick, reliable, and inexpensive test to determine if a person has a virus or if water was contaminated by bacterial infection? What if they could change the world through biochemistry?

This lesson can be utilized throughout the entirety of the biology curriculum, but the global consciousness impact is most profound. Students will be asked to think about socioeconomic differences, differences in access to healthcare, and their ability to enact great change through scientific exploration and endeavor.
Does paper matter?

What is the experimental part of the lesson?

Students will design and perform an experiment to test the hypothesis that different paper will create variability in the outcome of a known protein assay.

The protein assay we will be using is common and can be accomplished inexpensively using citrate buffer, tetrabromophenol blue, and bovine serum albumin (BSA). The variable will be different types of paper. Students need to form a hypothesis as to what type of paper, if any, will perform better. For data analysis, students will be using cell phones and a photo box to capture images of their experiment and assessing color intensity and microarray color analysis using Image-J, a free program.

What is the assessment of this lesson?

Formative assessments will be in the form lab meetings where each group discusses what they accomplished, what challenges they faced, good things for the class to know, and what lessons they learned from their exploration. This allows community discussion of the ongoing project and for the group to reach a consensus answer of the results of the experiment.

What should the students know upon completion?

Through the exploration of this dilemma, students will be able to analyze the structure and function of proteins and viruses. They’ll develop a model to explain the role cell specialization plays in the function of viruses and how they interact with humans. They will communicate how feedback mechanisms work as well as how they are used to assess illness. They will also study the patterns of infectivity cycles to infer cause and effect of viral evolution.