

Lesson Plan

Title:
A Case Study of Sickle Cell Anemia
Primary Subject Area:
Biotechnology & AP Biology
Grade Level:
12th
Overview:
Students often question the objectives of the lesson (when I am ever going to use this again in the real world?). As a result, when planning my lessons, I try my best to make connections between the objectives and students' lives. The challenge, however, lies with teenagers wanting that connection to be made about them in this moment. They don't want to hear, "10 - 20 years from now when you have children of your own," or "your parents...." Given that 70% of my student population is African-American, sickle cell anemia is a concept that all of students have some connections to. At times a student may feel that the topic is irrelevant to his/her life or world only to find out their lab partner has the disease or is a carrier. Sometimes, their lab partner may not be able to make it to class or their group meeting because he/she has to stay home with siblings because the parents are in the hospital with sickle cell etc...
Approximate Duration:
Two weeks
MA Framework:
3.3 Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring. 5.3 Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population. SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations.
Interdisciplinary Connections:
Students will bring background knowledge from: Physics – Brief discussion of optics (properties of light) in microscopy and spectrophotometry Chemistry – Brief discussion of molarity during buffer preparation Math – Ratio of sickle cell vs. normal cell, population genetics-Hardy Weinberg equilibrium calculations Information Literacy – Research skills in academia (google scholar vs. wikipedia) ELA – That goes without saying... Technology – In addition to information literacy, using the appropriate tools to create the multimedia presentation
Lesson Objectives:
<ol style="list-style-type: none"> 1. Student Will Be Able To (SWBAT) conduct background research on sickle cell anemia 2. SWBAT design an experiment to investigate one of their own questions about sickle cell diagnosis 3. SWBAT articulate and explain the major concepts being investigated and the purpose of their investigation. 4. SWBAT construct explanations based on scientific evidence as to how mutations can lead to evolution 5. SWBAT create a multimedia presentation to communicate their results with the class.

Lesson Materials and Resources:

1. Sickle Cell Anemia Case Study Handout.
2. Additional literature
3. Celestron PentaView LCD Digital Microscope
4. Sickle cell samples
5. Test tubes and test tube racks
6. Microscopic slides of sickle cell blood

Technology Tools and Materials:

1. Projection unit
2. Students access to internet (laptop)
3. Microscopes
4. Spectrophotometer
5. Gel electrophoresis apparatus, chamber, battery pack etc.

Background Information:

In general biology, students should have been introduced to the concept of sickle cell as a genetic disorder; the basic background of the disease and its ties to mutation and evolution. If that is not the case for all students, they will learn it during the literature research of this lesson. In addition, students are expected to have had some basic microscopy skills, an introduction to gel electrophoresis, and spectrophotometry. Again, not all of my students had the same biology background. So, this lesson is better implemented mid way through the course after the students have been exposed to the various investigative tools around the lab.

Lesson Procedures:**M-Day I – Project Introduction**

- ✓ As an admit slip (AS), students will be asked to do a quick brainstorm about sickle cell (list 10 – 20 terms that come to mind when you here the term “sickle cell”.)
- ✓ Students report their working lab group (3-4 students).
- ✓ Share time and discussion of the disease.
- ✓ Each student is given pages 1 & 2 of the case study to read.
- ✓ Use the letter from Irvin Sherman to Dr. William Castle to develop diagnostic protocols to sickle cell.
- ✓ In their working lab groups students will hypothesize why there is a difference in sickle cell absorption of light waves...
- ✓ Homework: Use google scholar and any other source of peer-reviewed journals to research various articles that have been written about sickle cell. Make sure to 1. Read and take notes on the background of the disease (5Ws & H). 2. Find articles that discuss methods of diagnosing the disease. 3. Be prepared to share your findings with your lab group & the entire class. (minimum 5 articles)

Note: Students are given 3 days to complete the HW

TH-Day II – Research Presentations

- ✓ Students are assigned numbers as they walk in to class –AS: Students are asked to report to their lab groups and share their findings. Then as group, synthesize a 1-minute multimedia presentation to share their findings with the class (emphasis on diagnosis).
- ✓ Students’ presentations...
- ✓ Discuss presentations of possible diagnostic investigation (brainstorm which ones do we have the hardware to run? microscopy, gel electrophoresis, spectrophotometry)
- ✓ As a group, agree on one diagnostic investigation you would like to design and test (& a second choice). Students get to choose their topic based on their assigned numbers (first come first serve).
- ✓ Homework: students are given pages 6-8 of read and answer the analysis questions.

F-Day III – Investigation Protocol Development -

- ✓ AS: Students are given a handout of a text describing investigation design protocol and some Q & As.
- ✓ Brief discussion of investigation design
- ✓ Based on their assigned system, students design the protocol for their investigation.
- ✓ Approved protocols must include: having completed the “ Designing & Conducting an Independent Investigation” template materials needed and timeline...

Note: ordering of materials must be timely

Day IV – Investigation

- ✓ Students re-assess their materials, investigation question ect...
- ✓ Complete the investigation
- ✓ Collect data
- ✓ Students are given pages 3-5 & 9-10 of the packet.

Day V – Data Analysis

- ✓ Discuss how the collected data addresses the question of your investigation
- ✓ Do you need to collect additional data?
- ✓ Do you have all necessary information to create a multimedia presentation to share your findings with the class?
- ✓ Okay, get to it...

Note: In addition to Day V class time, having a couple of days (including a weekend) prior to students' presentations may improve the quality of the presentations.

Day VI – Students' Presentations

- ✓ Multimedia: poster, video, website, ppt, publisher, flash, etc...

Assessment Procedures:

Formative: Student-student and teacher students' interaction throughout the process (Q & A), admit slip questions etc...

Summative: presentation, open-response exam questions

Accommodations/Modifications:

When designing my lessons I use a Universal Design for Learning (UDL) approach. The materials, the methods, the assessments are flexible and diverse enough to provide appropriate learning experiences, challenges, and supports for all students. Hence, no accommodations/modification necessary

Reproducible Materials:

Same as Lesson Development Resources

Explorations and Extensions:

Careers in: Genetic counseling, bioinformatics, molecular biology etc...

Lesson Development Resources:

Case Study: <http://sciencecases.lib.buffalo.edu/cs/>
Designing Independent Investigation handout

Reflections:

N/A

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