Killing Cancer, Not People
Can we design a better type of chemotherapy?

Practice Elements:
Evaluate Solutions to complex real world problems

Crosscutting Concept Elements:
Patterns, Cause and Effect, Scale, Systems, Structure and Function

Disciplinary Core Idea:
From Molecules to Organisms: Structures and Processes

Component Idea:
Structure and Function, Growth and Development of Organisms

Target Grade Level: 10th

Students will use data to construct and revise an explanation as to the relationship between chemotherapy and cell death as it relates to the structure of doxorubicin and how the drug is delivered to cancerous cells and stops cellular reproduction, thereby eliminating the cancer.

Lesson Summary

It would seem that in this day and age everyone knows someone who has been inflicted with cancer, and typically the treatment includes chemotherapy. With chemotherapy come many undesirable but well known side effects such as hair loss, weight loss, and a general sense of misery. Is there a better way to treat this deadly disease? How do scientists select drugs and delivery systems to combat cancer?

During the partnership activity, the students will use data related to cancer cells and the drugs in questions for toxicity and time release based on the delivery system. The students will then create graphs showing the cancer cell line viability against concentration of selected drugs as well as drug concentration in medium over given time at specific body systems based on delivery method. Students will then analyze data to determine various drug IC50’s, overall toxicity against all cells, and the construct an explanation for which drug is most effect against specific types of cancer based on their function and delivery system.

Throughout the lesson the teacher will be asking driving questions to facilitate student work and comprehension of the data being graphed and what conclusions may be established. This should be accomplished by moving from group to group assessing progress as well as informally assessing understanding, re-teaching graphing techniques where applicable, and inquiring to student conclusions about IC50’s against time and overall cell toxicity.

The ISU partner will start the activity by giving a short focus lesson on their particular research, novel drug design, and the implications of the data given to students in that it is actuality data that is used in upper academia. The ISU partner will mirror the teacher in assessing student graphs and conclusions while being able to answer higher level questions regarding specifics on the work in laboratories currently.

Connections to the Next Generation Science Standards

High Resolution Tumor Cell
Dwain Dsouza, Techaeris, 2016
One aspect of the lesson

Is there a better way to administer chemotherapy such that the side effects are limited or non-existent?

Other Resources

DNA and Dox

Liposomes and Tumor Targeting

Liposome Modification and Loading

Science Partners

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Additional Unit Plan Info:
http://bit.ly/2a4TeCF