**Modeling in AP Biology**

**Lesson: Experimental Design**

**Theme(s) I - Science as a Process Topics IA - Enzymes**

**Authors: Kimbell Reitz, John Gensic, Susan Gursky (editor) Leading Questions(s):**

What makes an effective scientific experiment?

How can we test how other types of cells respond to H2O2?

**Engagement -**

John cuts his hand while working in his wood working shop. His mom pours hydrogen peroxide on it to kill the bacteria, and it bubbles. John wonders about this. He knows that the bubbling is oxygen being produced by a cellular reaction and decides to see how other types of cells respond to the hydrogen peroxide as well.

**Summary of Investigation:**

Students will design experiments that test how cells respond to H2O2.

**Equipment Used:**

-Potatoes

-Yeast

- liver suspension (optional)

-(cooked potato, dry yeast and boiled liver suspension also, optional)

-Test tubes

-General lab equipment

-Hydrogen peroxide (3%)

**Description of Procedure, notes (teacher manual)**

The teacher will introduce the engagement story to the students and tell the students that they will be designing their own procedures to test how cells respond to hydrogen peroxide. Ask students to whiteboard what they think a good experiment looks like. The teacher should have a collection of equipment and model organisms available for the students so that the students can see what they have to work with. The students may desire other equipment and the teacher may allow the use of this other equipment at their discretion.

The students should work in groups to discuss and design a procedure. When most of the groups are ready they should put their results on the white board. The class

will then come together and each group will explain their experimental design. At this time the other groups and the teacher will ask leading questions. The important points of experimental procedure include: controls, replicates, dependant and independent variables, data collection and analysis.

**Questions for Board Meeting on Procedures:**

1. How many test tubes will you set up?

2. What will you be measuring? How? How often?

3. What things will you control?

4. What are some variables that might influence your results if you’re not careful?

5. Why do you need to do so many set ups?

**Follow up:**

After the students have gathered data they will model on the whiteboard. They should model: what we saw, what we think happened, questions we still have.

During the board meeting with the whole class, the teacher should direct questioning toward the following:

-What new questions arose from your test?

-How could we test that?

-What is the value of having replicates?

-What problems did you have with the procedure?

\***Why did some systems have more bubbles than others?** This is an essential line of questioning that leads to the next stage of experimentation, reaction rates.

During this line of questioning the teacher will want to pull such things out as temperature, pH, salinity, enzyme concentration, and substrate concentration. Other variables might be light quality and intensity, “freshness” of cells, “freshness” of hydrogen peroxide solution, etc. Have one variable for each lab group to test.

**For Journal:**

What is necessary to make a good experiment?