**Revised QR Lesson**

**Revised QR goals﻿﻿**

1. Knowledge and Conceptual Understanding:  Students will organize, summarize and mathematically represent (charts, table, graphs, etc) observational data.
2. Thinking and Other Skills:  Students will evaluate if collected data from class experiments supports or refutes their initial hypothesis.
3. Attitude, Values, Disposition and Habits of Mind:  Students will be comfortable discussing what if any conclusions can be drawn from their experimental data.  They will also be comfortable devising new experimental questions that can be posed based on these conclusions.

**Revised QR Lesson**

1. Students will *be divided into groups* of 3 or 4 and given a table that contains sample results from an experiment about Facilitated diffusion. Student will be asked to:
   1. ﻿Review the data table below.
   2. In their own words summarize the data set in two to three sentences.
   3. Identify the independent and dependent variables of the data set (For review, watch video on dependent and independent variables posted on BlackBoard)
   4. Graph the data set. Students will need to determine if they should use a pie chart, bar graph or line graph to do so.

*Below is a description of an facilitated diffusion experiment adapted from an exercise presented in our Biology textbook. Prior to this exercise students will have read text and reviewed videos on mechanisms of membrane transport, read text and reviewed videos on scientific method, read text and reviewed videos on data presentation (e.g., creating tables and graphs, identifying dependent and independent variables).*

***Facilitated Diffusion Exercise***

***Is Glucose Uptake into Cells Affected by Age****? Glucose, an important energy source for animals, is transported into cells by facilitated diffusion using protein carriers. In this exercise, you will interpret a graph with two sets of data from an experiment that examined glucose uptake over time in red blood cells from guinea pigs of different ages. You will determine if the cells’ rate of glucose uptake depended on the age of the guinea pigs.*

***How the Experiment Was Done****: Researchers incubated guinea pig red blood cells in a 300 mM (millimolar) radioactive glucose solution at pH 7.4 at 25°C. Every 10 or 15 minutes, they removed a sample of cells and measured the concentration of radioactive glucose inside those cells. The cells came from either a 15-day-old or a 1-month-old guinea pig*

**Table: Glucose Uptake over Time in Guinea Pig Red Blood cells**

|  |  |  |
| --- | --- | --- |
| Incubation Time (min) | Concentration of radioactive glucose (mM) for 15-day old guinea pig | Concentration of radioactive glucose (mM) for 1 month old guinea pig |
| 0 | 0 | 0 |
| 10 | 51 | 22 |
| 20 | 72 | 33 |
| 30 | 86 | 40 |
| 45 | 96 | 48 |
| 60 | 104 | 55 |

*Adapted from Campbell Biology 11th Ed, Pearson Education Inc*

1. Students will:
   1. Develop a hypothesis to explain the difference between glucose uptake in red blood cells from 15-day old and 1 month-old guinea pigs. (Review discussion about facilitated diffusion and glucose transport posted on BlackBoard)
   2. Within their student group, design an experiment to test their hypothesis.
      1. Include a description of the procedure that will be used to test the hypothesis
      2. Describe what statistical data would be needed to support their hypothesis
      3. Discuss how to graphically present the required data necessary to support their hypothesis
      4. Discuss with group members the potential outcomes of the experiment
      5. As a class, share experimental designs and discuss if experimental designs are effective in testing hypotheses.

I think 2a and 2b will satisfy learning goals 2 and 3. While students will not actually be conducting an experiment, the exercise offers the opportunity to design an experiment, discuss possible outcomes of the experiment and discuss what statistical data is necessary to support hypothesis. Students will also compare and contrast experimental designs of their classmates.

1. ~~Students will be asked to predict outcomes if specific variables were changed. Students should present an experimental design to test the possibility of the predicted outcomes~~.