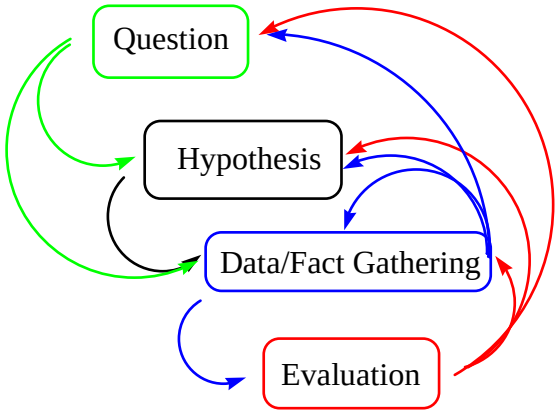
THE SCIENTIFIC METHOD

(this activity appears originally at http://www.umich.edu/~chemstu/syllabus/syllabus.htm and is used in this course with permission of the authors)

One of the goals of the course is for you to learn about and practice scientific inquiry. One model that we will use this semester for the process of science inquiry is shown in Figure 1.

Figure 1: Simple Model of Scientific Inquiry



Question: a puzzle, a mystery, a surprising event…hmmm I wonder if….

Hypothesis: A testable statement about the natural world that can be used to build more complex inferences and explanations

Testing: Prove or disprove a hypothesis by collecting facts. If a hypothesis is correct, what should be observed? What data would show that a hypothesis is wrong?

Evaluation: Decide whether the results of testing warrant accepting the hypothesis as a plausible explanation for the phenomenon. Consider the possibility of further testing, and whether other hypotheses might provide a better explanation.

Today, we will be begin with two examples of how other scientists have attempted to ask and answer questions using science.

Read the two papers from G*eneral Dentistry* and *The Journal of the American Medical Association*. You many not understand everything that you read. You are primarily looking for the process of Scientific Inquiry as your read them. In laboratory on May 20, work with your group to tackle the questions.

(Re-)read the article from the "General Dentistry"

1) What questions do you have about the article?

2) What question/s are the authors of this paper trying to answer?

3) What was their hypothesis?

4) What facts were the hypothesis based on?

5) How was the data presented?

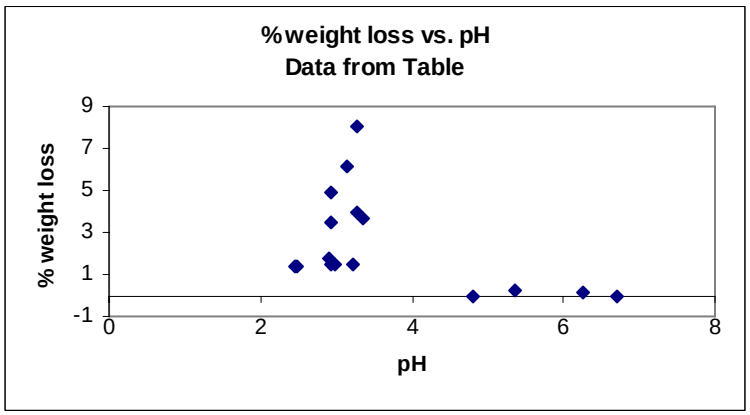
6) What other ways could the data have been presented? What is the most useful way to present data?

7) Describe the 'control' used in this experiment:

8) Any thought on why is it important to look at % weight loss instead of absolute weight loss? Think about your teeth!!

9) Is there a direct correlation between pH and tooth weight loss? Explain using the data in Figure A below.

Figure A: % weight loss vs. pH



10) Will drinking diet soda prevent enamel loss better than drinking regular soda?

11) Do all sodas in Figure 4 have the same effect on enamel loss? If there is a difference, how would you group the sodas in describing this difference?

12) What hypothesis about sodas and tooth weight loss might you propose based on this data?

13) How would you test your hypothesis?

14) One of the self-critiques of the study is its small sample size. Are you convinced that drinking soda will cause an increase in dental caries?

15) Where any facts created as a result of this data?

16) Were any laws supported or put forth as a result of the research?

17) Any theories or models formulated?

Now (re-)read the article from the Journal of American Medical Association.

18) What was the driving question for the research study in the *JAMA* article?

19) What was the initial hypothesis presented by the researchers?

20) What was the rationale for the hypothesis? (Was it based on facts of a guess?)

21) The researchers chose to use tables to represent their data. Sketch a graph of their data that they might have used.

22) Did the data collected support their hypothesis? Explain.

23) Briefly describe how you might test a hypothesis put forth in the paper.

24) Were any facts, laws, or theories developed based on this study?

25) The authors of the *Dentistry* paper were self-critical of their sample size. What self-critique did the authors of the *JAMA* paper offer? Is it deserved?