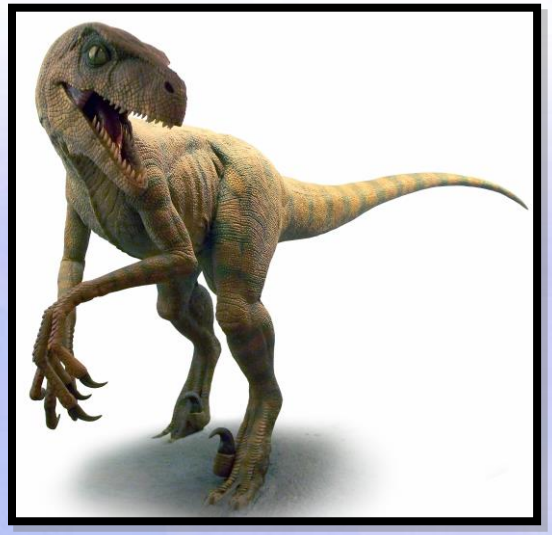
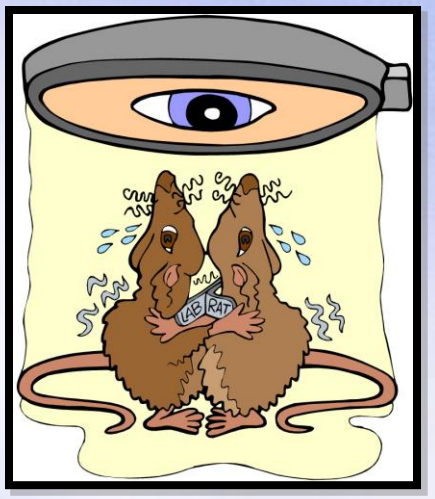




INTRODUCTION TO THE SCIENTIFIC METHOD

How to take notes:

- For the first semester, you will have a FIB (fill in the blank) page or similar type of page.
- On this page, record important information. You can tell if it is important – it is RED!

Why use the Scientific Method?

The goal of science is to investigate and understand the natural world, to explain these events, and to use those explanations to make useful predictions.

Scientists use this method to:

Collect and organize information in a careful, orderly way, looking for patterns and connections between events.

Scientific Method

The scientific method is:

A series of steps used by scientists to solve a problem or answer a question.

The Steps to the Scientific Method:

1. Question or Problem
2. Form a Hypothesis
3. Experiment
4. Record and Analyze Results
5. Draw Conclusions and communicate them

Observations

Science begins with an observation.

This is the act of using one or more senses to gather information and to make note of what occurs.

Data is the information gathered from making observations.

Observations vs. Inferences

If observations refer to noting a fact or occurrence by using our five senses

- Then what are inferences?
- Inferences are explanations or interpretations of what you are observing. They are statements that may give an explanation to what you are observing

Let's try it!

Look at the picture:

- What can we infer from looking at this picture?

Possible inferences include:
It just finished raining or still may be raining.

The sun will come out and it has finished raining for the day.
It was thunder storming earlier.

Now what?

- So you observe something and now you are curious about it.
- Now, you need to come up with a question!

Question or Problem

A problem or a question must first be identified, before an experiment can begin.

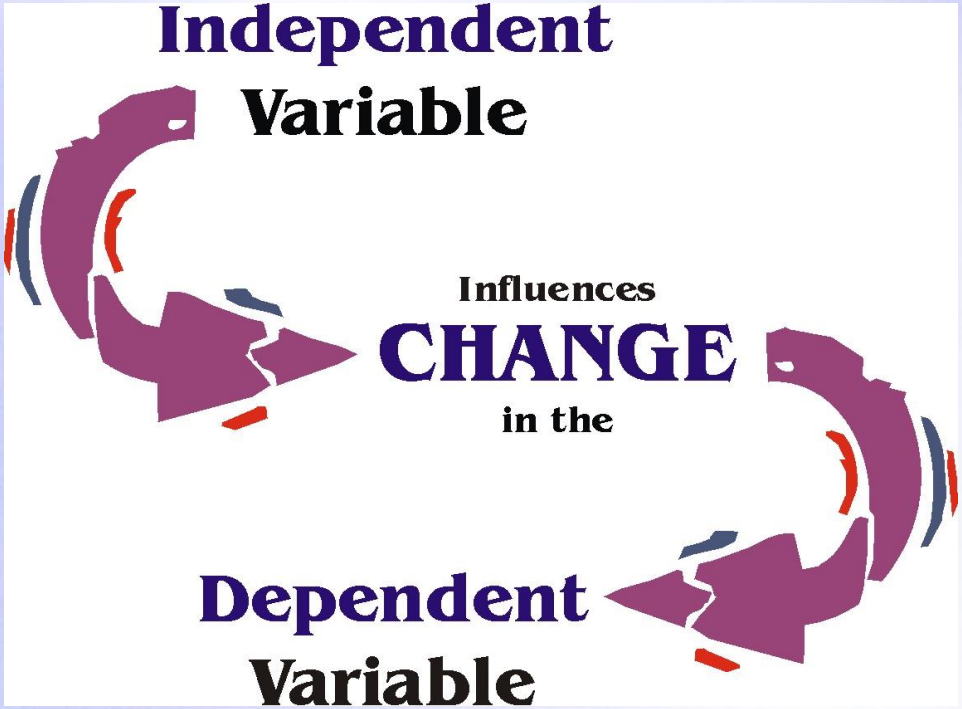
The purpose of the question is to narrow the focus of the inquiry, to identify the problem in specific terms.

How do you ask an “in-depth” or testable question?

There are three variables in an experiment:

1) The independent variable is the variable that is deliberately changed by the scientist.

2) The dependent variable is the one observed during the experiment. The dependent variable is the changing data we collect during the experiment. This data is collected as a result of changing the independent variable.



There are three variables in an experiment:

Example experiment:

A scientist studies the impact of withholding affection on cats.

What is the IV?

What is the DV?

The independent variable is the amount of affection.

The dependent variable is the reaction of the cats.

Controlled variable:

A third variable is the constant or controlled variable.

- It is important to know that the results of an experiment are due to changes in the independent variable.
- A control confirms the reliability of the results
- If the control remains unchanged, observed changes are due to the independent variable.

Hypothesis

Definition: A possible explanation for an observation that can be **tested** by scientific investigation. It refers back to the question or problem.

Generally, a hypothesis is stated as an "if … then" statement. In making such a statement, scientists engage in **deductive reasoning**.

In our case we will sometimes add the “because” as well. For example: If we add 5 grams of salt, then the chemical will react **because** salt makes the reaction faster.

Hypothesis (cont'd)

Deduction requires movement in logic from the general to the specific.

Here's an example: **If** the amount of sun on a tomato plant is increased (general statement), **then** the plant will grow to 4 feet tall (specific statement). What might be a "because"?

•Once you have a TESTABLE Hypothesis, you do an experiment.

During the Experiment…

- You collect data!
- Data can looks different, but it is found as 2 main types

Data Collected

This is chart of the numerical data collected in my experiment…

Independent Variable (This is the *one thing I changed in my experiment.*)	**Trial 1**	**Trial 2**	**Trial 3**	**Average** (Add the three trials together and divide by three.)

Data gathered from the experiment:

Two types of data:

1. **Quantitative** - information about quantities; that is, information that can be measured and written down with numbers.

2. **Qualitative** –It is information about qualities; information that can't actually be measured.

Examples of data:

- Your age. (Quantitative)
- The number of hairs on your knuckle. (Quantitative)

- The softness of a cat. (Qualitative)

- The color of the sky. (Qualitative)
- The number of pennies in your pocket. (Quantitative)

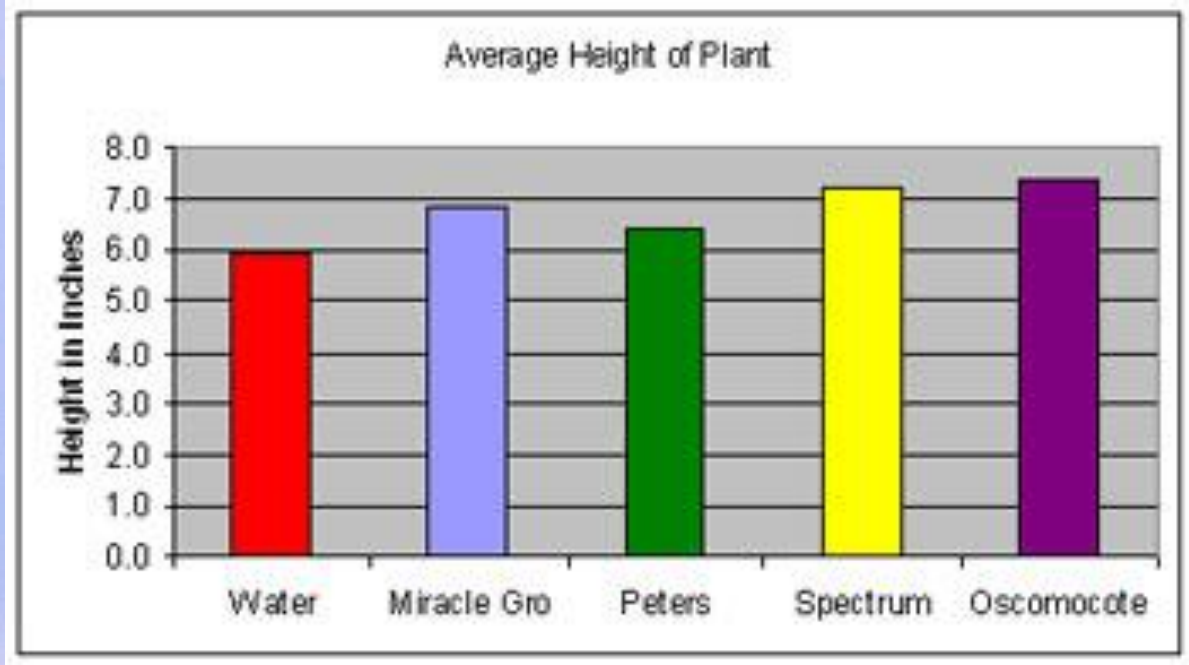
Raw Data and Analyzed Data

- Raw data – what is collected from the experiment
- Analyzed data – the collected data has been looked at, people decide what is means and then communicate their conclusions. This is often presented as a graph and then the meaning of the graph is discussed in written form.

Analysis and Results

The data that has been collected must be organized and analyzed to determine whether the data are reliable.

Data is analyzed and compared, often in charts, to determine if it supports the hypothesis or not.



Experimental Errors

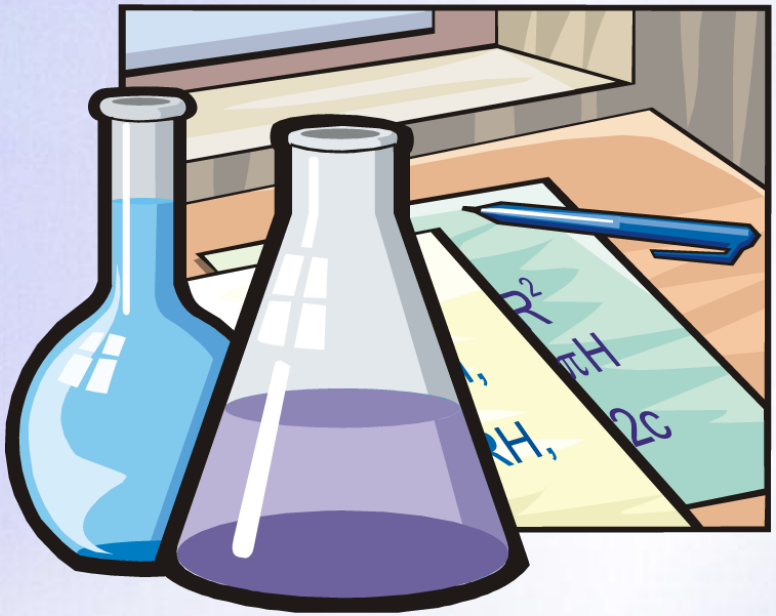
- Errors of Measurement
- Scientists use tools to do experiments
- These tools need to be working properly, as well as scientists knowing how to use these tools
- For example, a balance must be “tared” or set to zero before use. A scientist must need to know how to do that in order to have correct measurements.
- In every experiment, errors are possible. You need to take these into account when communicating your own experiments.

Drawing Conclusions

The conclusion includes results, analysis of data and lesson learned.

The evidence from the experiment is used to determine if the hypothesis is proven or disproven.

1. What did you learn
2. Was the hypothesis correct?
3. What are mistakes made
4. Questions you have now or ideas for improvements



Repetition and Replication

- There are two ways that scientific investigations can be re-tested.

1. The scientist who did the study can repeat the study

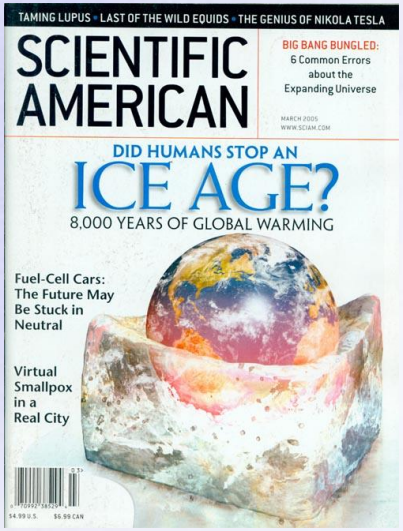
- Multiple repetitions with similar results provide support for the original findings

2. Or, other scientists can replicate the first investigation

- Replication of the work by other scientists provides even more support for the work!

Communicating Results

- Scientists write articles
- Make presentations to other scientists
- Other scientists may then try to replicate the first experiment, or even find evidence that the first experiment is wrong.
- Multi-media communication around the world is common now



Scientific Method in Action

- It is not a straight line of steps!
- Depending on the experiment, some steps may be repeated over and over, while other steps are not needed.
- Sometimes, testing the hypothesis leads right to a conclusion! And sometimes no definitive reason has been found yet!

Organization

- Make sure to bring your supplies tomorrow!
- These notes will go in your “Notes” section of your binder.
- If you have it now, hole punch it and put it safely away.

Now – let's see what you know!

- Scientific Method Stations
- You will revolve around as a group to the different stations
- You will rotate in numerical order.
- Make sure you are filling in information on the correct station!!