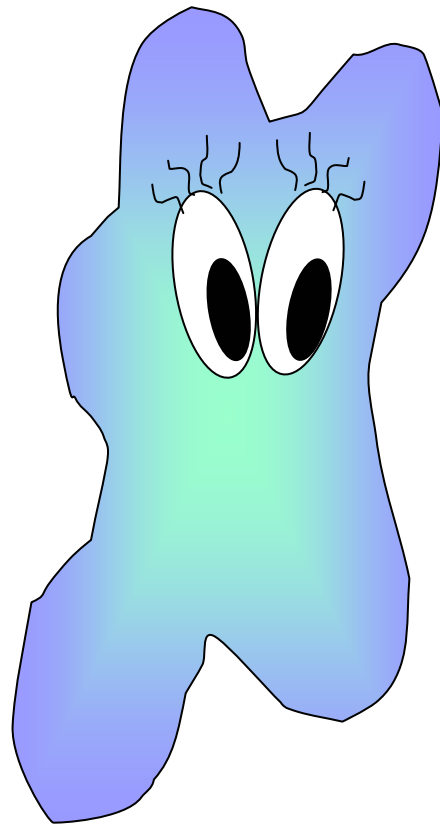
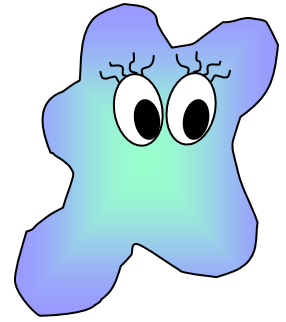


The Scientific Method





The Scientific Method

All investigations, scientific or otherwise, begin with a **QUESTION**. This question may be far reaching or focused specifically on a single topic. For example: **Do any plants have the ability to cure human illness?** (broad) *or* **What are the benefits of taking a herbal supplement such as Ginseng?** (narrow and specific). Whatever your topic, you need to have a goal question in mind before starting the investigation.

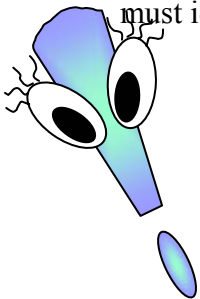
QUESTIONS - A focusing question for an investigation that can be answered through an experiment.

- I. Does the amount of water effect the growth of a plant?
- II. What effect does Ginseng have on blood pressure?
- III. What is the strongest beam design for building skyscrapers?
- IV. Do boys and girls have different strengths and weaknesses in math and language arts?
- V. Does age have any affect on reflexes?
- VI. What time of day does the sun create the longest shadow?

The **Scientific Method** is a systematic way of proving a hypothesis right or wrong. In order for your experiment to be a **Fair Test** you need to prove in your investigation that nothing outside what you change could have affected the results of your experiment. This is accomplished through identifying your **VARIABLES**, and being sure to only have a single manipulated variable in your experiment.

VARIABLES

Simply put, a variable is something that can change, could change or you are looking to change in your experiment. In a **Fair Test** investigation there are three variables that you must identify before continuing with your experiment:



MANIPULATED VARIABLE – What you intentionally change.

- I. amount of water to give to plants,
- II. dosage of Ginseng herbal supplement
- III. a structural design change (ex. I-beam, or tube beams)
- IV. boys vs. girls
- V. age
- VI. time of day



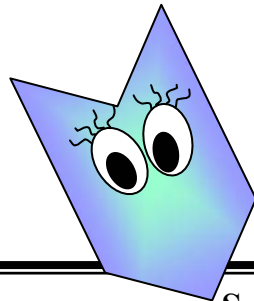
RESPONDING VARIABLE – The change that you look for to happen when you change your manipulated variable.

- I. differences in plant growth and health
- II. rise or fall in blood pressure
- III. difference in weight that can be supported on each design
- IV. test scores in Math and LA
- V. reflex speed
- VI. shadow length



CONTROLLED VARIABLE – Identifying factors that may change the results of your experiment. You may have many different controlling variables that you will need to control in order for your test to be fair.

- I. light source, soil, plant, watering time,
- II. dosage, time of day, no coffee before test, no stresses in room,
- III. structural design, materials used, weight applied, no wind, steady table
- IV. same test questions, quiet space to write, same time of day, random selection of subjects
- V. same reflex test, instructions same, test both males and females
- VI. same shadow maker (a.k.a. gnomon), placement of gnomon, same day of year



Section Reflection

1. Come up with your own scientific question, something you are curious about and that can be experimented with.

2. What would be the variables in your experiment?

Manipulated : _____

Responding : _____

Would have to be **Controlled:** _____

RESEARCH – During this phase of your exploration you are required to undergo an in-depth research into all of your variables. Through your research you may find the answer to your scientific question; that’s all right! Remember your experiment will prove that the answer you find is correct, or in some cases incorrect. Either way you have an excellent set of data in which to share.

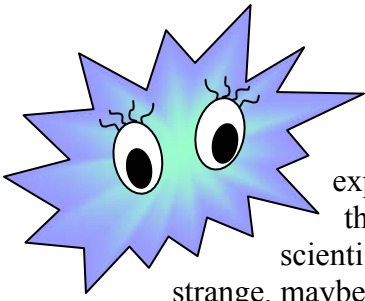
HYPOTHESIS – Once you know more about your question and variables you now have the opportunity to predict what may happen when you complete your experiment. You are making an informed prediction about what your data may look like.

A hypothesis is usually written in the form of an IF-THAN statement, and can be phrased as: IF I (*insert manipulated variable here*) in my experiment, that (*insert what you think is going to be your result here*). For example:

- I. **If** the water is increased, **than** the plants will grow taller than those with less water.
- II. **If** a Ginseng tablet is given to the subjects, **than** an increase in their heart rate will be recorded.
- III. **If** an I-beam is used in the construction of a tower **than** it will support more weight than a tower built with tube beams.
- IV. **If** males and females are tested in both math and language arts, **than** it will be noted that the girls will out-score the boys in both areas.
- V. **If** people of varying ages are tested, **than** the older a person is the slower the reflexes will be.
- VI. **If** a sundial is checked at different times of the day, **than** a longer shadow length at sunrise and sunset.

MATERIALS – This is a list of the materials you are planning on using during for your experiment, this should include EVERYTHING you use, even down to the place in which you are planning on completing the experiment.

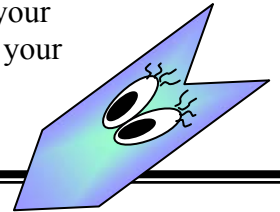
PROCEDURE – This is a step-by-step set of instructions for what you are planning on doing in your experiment. These are **always** given in **full sentences** in a number list. The instructions should be complete and understandable.



DO THE EXPERIMENT! – Now you are ready to complete your experiment. Make sure that you save time to complete your experiment three times to make sure you get the same results each time. A good scientist uses at least three trials, if you notice that your results are a little strange, maybe you need to do the experiment more than three times. You be the judge.

CONCLUSIONS – Based on your research and observations, make an inference about the cause of the changes that you saw. Was your hypothesis correct? Why or why not?

FURTHER QUESTIONS – Can you think of any more questions that your experiment has raised that you are still not sure about? If the answer is no, then your experiment is either so unbelievably complex or way too simple.



Section Reflection

What are the **MATERIALS** and **PROCEDURE** for making a packaged product, such as Jell-O, pudding, or Mac-N-Cheese? Find a package and record the materials you require and the procedure here.

Materials:

Procedure: 1.

2.

3.

4.

5.

etc.

