Scientific Method

Steps in the Scientific Method
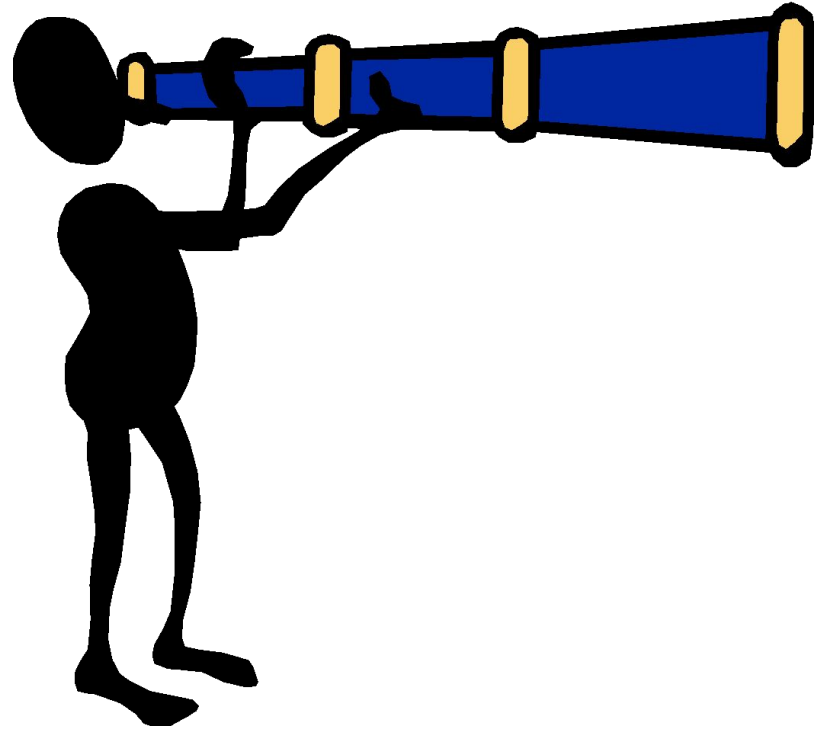
- **Observation**
- **Hypothesis**
- **Experiment**
- **Data Collection**
- **Conclusion**
- **Retest**

Observations
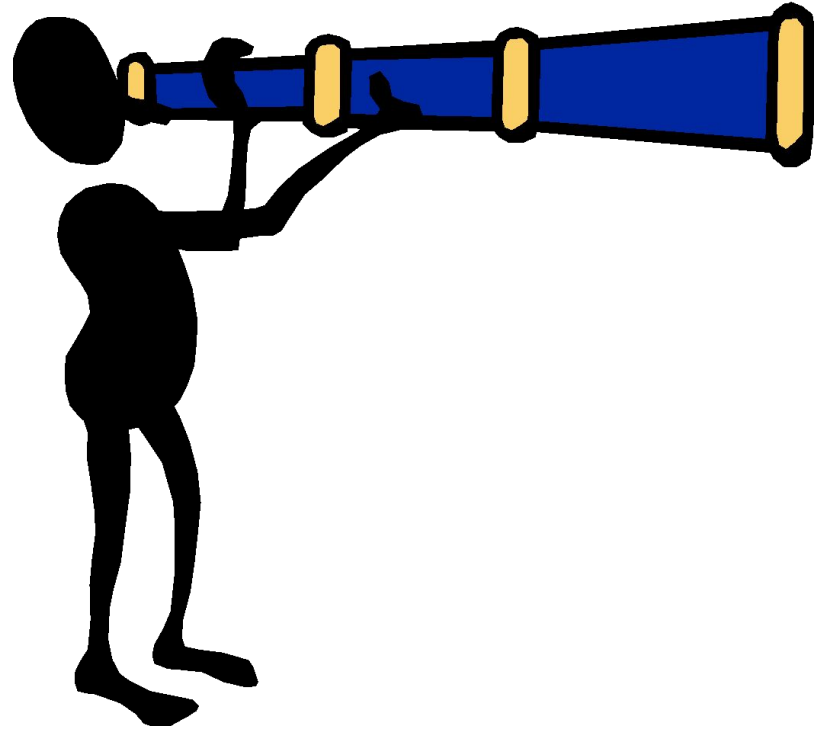
- Gathered through your senses
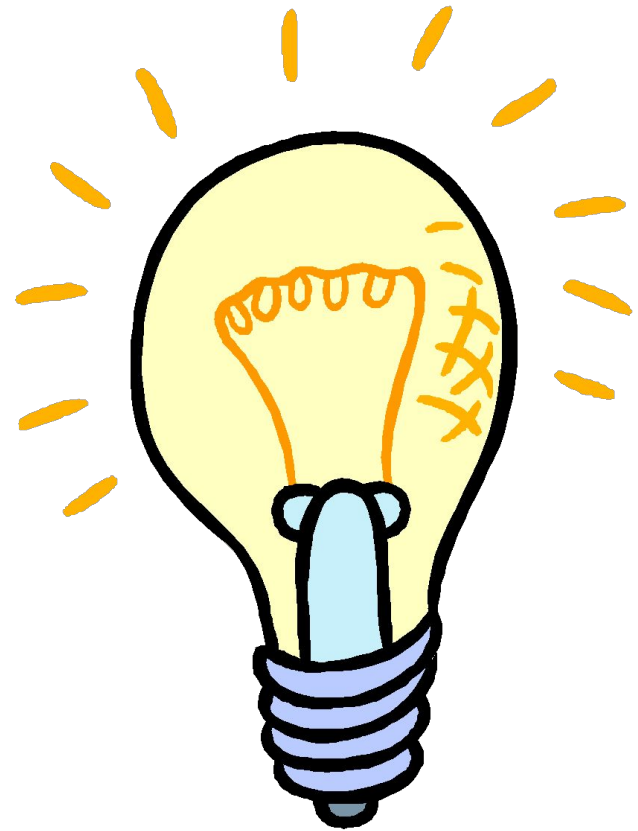- A scientist notices something in their natural world

Observations

- An **example of an observation** might be noticing that many salamanders near a pond have curved, not straight, tails
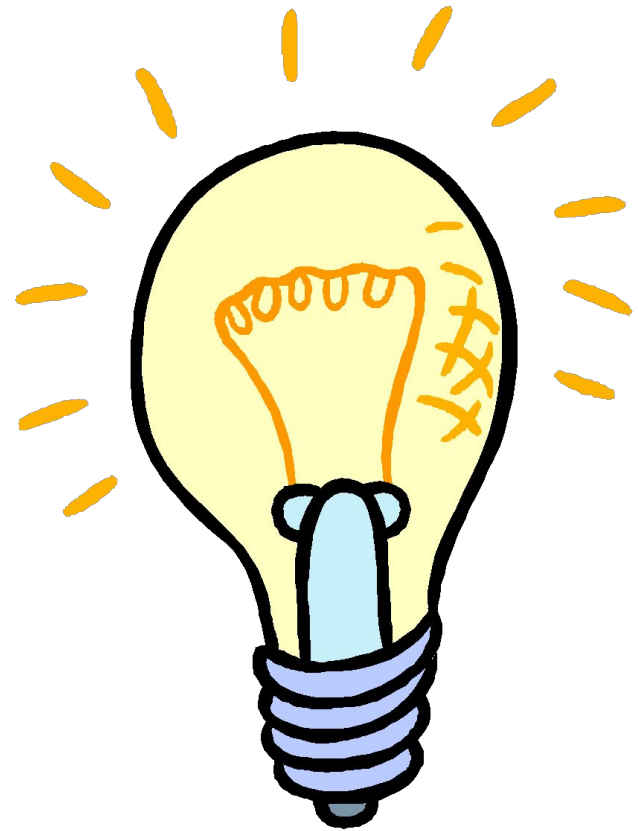
Hypothesis

- A suggested solution to the problem.
- Must be **testable**
- Sometimes written as **If…Then…** statements
- **Predicts** an outcome

Hypothesis

- An **example of a hypothesis** might be that the salamanders have curved tails due to a pollutant in the moist soil where they live.

Experiment

- A procedure to **test** the hypothesis.

Experiment

Variable – factor in the experiment that is being tested

Experiment

A good or "valid" experiment will only have **ONE variable!**

Controls and Variables

Scientific Experiments Follow Rules

- An experimenter **changes one factor** and **observes or measures** what happens.

The Control Variable

- The experimenter makes a special effort to keep other factors constant so that they will not effect the outcome.

- Those factors are called control variables.

What is the Purpose of a Control?

- Controls are **NOT** being tested
- Controls are used for **COMPARISON**

Other Variables

- The factor that is changed is known as the **independent variable**.

- The factor that is measured or observed is called the **dependent variable**.

Example of Controls & Variables

- For example, suppose you want to figure out the fastest route to walk home from school.

- You will try several different routes and time how long it takes you to get home by each one.

- Since you are only interested in finding a route that is fastest for you, you will do the walking yourself.

What are the Variables in Your Experiment?

- Varying the route is the **independent variable**

- The time it takes is the **dependent variable**

- Keeping the same walker throughout makes the walker a **control variable.**
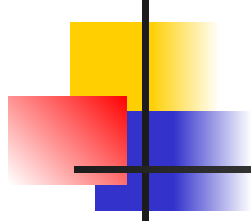
One more thing… it is best to make **several trials** with each independent variable.

Valid Experiments

Remember: To be a Valid Experiment:

- **Two groups** are required --- the control & experimental groups
- There should be only one variable

Data

- **Results** of the experiment
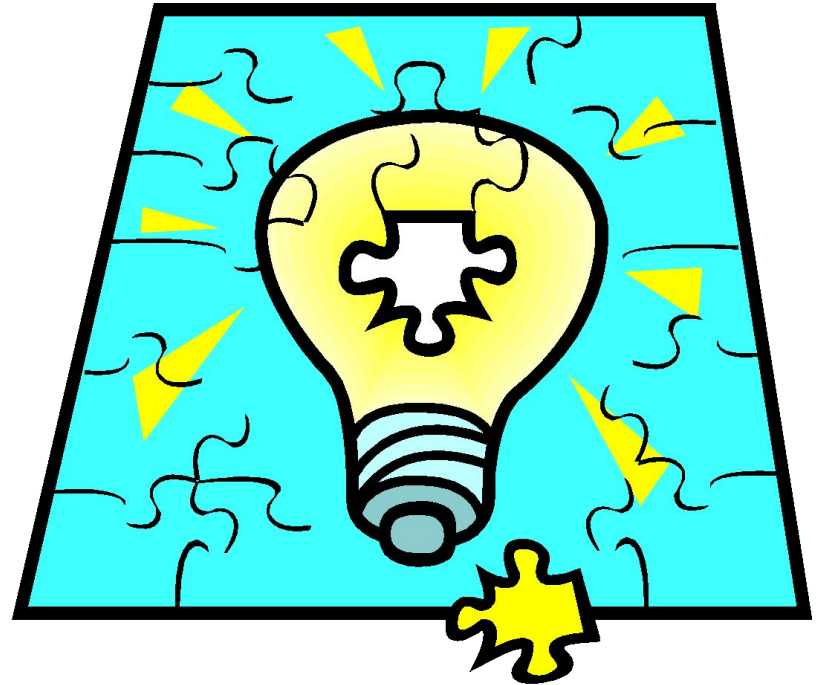- May be **quantitative** (numbers) or **qualitative**

Data

- Must be **organized**
- Can be organized into **charts, tables, or graphs**

Conclusion

- The **answer** to the hypothesis based on the data obtained from the experiment

Retest

In order to **verify the results**, experiments must be retested.

Review

Solving a Problem

1) **Identify** a Problem

2) State **Observations** about the problem

3) Form a **Hypothesis** about the problem (if…then…)

4) Design an **Experiment to test the hypothesis**

5) Collect **Data**

6) Form a **Conclusion**

7) **Retest**