

# Scientific Method Explained

## What is Science?

The Goal of Science

- 1) deals only with the natural world
- 2) to collect and organize information
- 3) propose explanations that can be tested

**Science** – using evidence to learn about the natural world; a body of knowledge

Science begins with **observations** – often taking data on what you see, hear or smell

**data** – the information gathered from observations

**quantitative data** = numbers

**qualitative data** = descriptive

**Inference** – a logical interpretation based on prior knowledge or experience (Ex. You see a window broken and a baseball on the floor next to the shattered glass. You can -infer- that a baseball broke your window)

**Hypothesis** – a proposed scientific explanation. This statement is testable and can be confirmed with experimentation or further observation.

**Prediction** – An if-then statement that shows what you expect to see as a result of an experiment or observation (Ex. If fertilizer makes a plant grow faster, then seedlings planted with fertilizer will be taller than the ones planted without fertilizer)



## Steps of the Scientific Method

- 1) Ask questions, make observations
- 2) Gather information
- 3) Form a hypothesis
- 4) Set up a controlled experiment

**Manipulated variable** – the variable that is deliberately changed (independent variable)

**Responding variable** is variable that is observed ( aka dependent variable)

- 5) Record and analyze results
- 6) Draw a conclusion
- 7) Repeat

## The Scientific Method in Action

Suppose you observed that a cricket outside your window seems to be chirping every night, but some nights it chirps faster than others. A friend of yours told you once that you can use the sound of a cricket chirp to tell the temperature. Curious, you decide to design an experiment. First you must create a **hypothesis**; here are some examples of possible hypotheses:

*The frequency of cricket chirps will change as the temperature changes.*

*As the temperature decreases, a cricket will chirp fewer times.*

*Either hypothesis will work, the important thing is that you can -test- the hypothesis by doing an experiment which will confirm or deny the statement.*

*To set up the experiment, you go out to your yard and capture a few crickets. You bring them inside and place them in a container. But wait, if you have a bunch of crickets together, what if they chirp based on how many crickets there are nearby. The goal in designing an experiment is to eliminate all the variables except the one you are testing. This means all your cricket subject must be housed in the same environment (same lighting, same food, same water..etc). Okay, so you get that set up and take the temperature of your room. Now you must wait for the crickets to start chirping. You count how many times the cricket chirps for a 5 minute period.*

*Now you have to compare that number with the chirps that occur at different temperatures. You may use a heating pad, or ice or any other way to lower or raise their temperature. You would then take data for 5 minutes at the new temperature.*

*In your experiment, the **MANIPULATED VARIABLE** is the thing you changed – the temperature. The **RESPONDING VARIABLE** is what you are measuring that happens as a result of that change - the number of chirps.*

*The **CONTROL GROUP** isn't obvious in this case – but you can consider your original (room temperature) data as your control, and the other temperatures your experimental data.*

*After you have taken data, you can then draw a **conclusion** about whether your hypothesis is accepted (correct) or denied (incorrect).*

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