

The Scientific Method

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- A logical approach to solving problems or answering questions.
- Dynamic process... sometimes doing an experiment leaves more questions than answers and opens up new avenues of scientific research

Scientific Method

- “controlled” experiment- designed to test one change at a time
- Hypothesis- best guess... typically given as an “if.... then...” statement
- Good record keeping is important- data must be reliable
- Perform multiple trials of the experiment

Controls and Variables

- **Variables**- the things that have an effect on the experiment
- **Independent variable**- is the variable that is changed or manipulated by the scientist.
 - To insure a fair test, a good experiment has only one independent variable.
- **Dependent variable**- the variable that the scientist observes to see how it responds to the change made to the independent variable.
 - The new value of the dependent variable is caused by and depends on the value of the independent variable.
- **Controls**- quantities that a scientist wants to remain constant.

Basic Steps of the Scientific Method (Note: Not all experiments follow these exact steps... every experiment is different!)

- 1.) Identify the problem to be solved or question to be answered
- 2.) Make observations about what you already know
- 3.) Formulate a testable hypothesis (best guess)
- 4.) Design and carry out a controlled experiment and collect data to test the hypothesis
- 5.) Draw conclusions based on your data and experiment and decide if your hypothesis was supported

• Theory (Model)

- A set of well-tested hypotheses that give an overall *explanation* or explains why- **not able to be proved**

• Natural Law (or Scientific Law)

- The same observation applies to many different systems; *summarizes* results
- an example would be:
the Law of Conservation of Mass

Scientific Method Scenario:

The Strong Mint company has created a secret ingredient for a breath mint that will "cure" bad breath. They have asked 100 customers with a history of bad breath to try the new breath mint. The company asked 50 customers (Group A) to eat a breath mint after they finished a meal containing garlic and onions. The other 50 (Group B) also received a breath mint after their meal; however, it was just a regular breath mint that did not contain the secret ingredient. Both Group A and Group B were told that they were receiving the breath mint that would cure bad breath. Two hours after eating the meal, 32 customers in group A and 14 customers in group B reported having better breath than they normally had after eating a meal containing garlic and onions.

Which people are in the control group?

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What is the independent variable? (What do the experimenters have control over?)

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What is the dependent variable?

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What conclusions can the company draw?

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Why do you think that 14 people in group B reported better breath even though they did not get the secret ingredient?