

## **Forming a Hypothesis**

A hypothesis is an educated guess or prediction of what will happen. But a scientific hypothesis is a carefully-formed guess to explain something based on all the facts in evidence. The facts come from observation and the results of experiments. The hypothesis ties all the facts together and suggests further observations and experiments.

A hypothesis proposes a relationship between factors called variables. A good hypothesis relates an independent variable and a dependent variable. The effect on the dependent variable depends on or is determined by what happens when you change the independent variable. While you could consider any prediction of an outcome to be a type of hypothesis, a good hypothesis is one you can test using the scientific method. In other words, you want to propose a hypothesis to use as the basis for an experiment.

## **Cause and Effect or If, Then Relationships**

A good experimental hypothesis can be written as an "if, then" or "if", "then", "because" statement to establish cause and effect on the variables. If you make a change to the independent variable, then the dependent variable will respond. Here's an example of a hypothesis:

If you increase the duration of light, corn plants will grow more each day.

The hypothesis establishes two variables, length of light exposure and rate of plant growth. An experiment could be designed to test whether rate of growth depends on duration of light. The duration of light is the independent variable, which you can control in an experiment. The rate of plant growth is the dependent variable, which you can measure and record as data in an experiment.

## **Checklist for a Good Hypothesis**

When you have an idea for a hypothesis, it may help to write it several different ways. Review your choices and select a hypothesis that accurately describes what you are testing.

Does the hypothesis relate an independent and dependent variable? Can you identify the variables?

Can you test the hypothesis? In other words, could you design an experiment that would allow you to establish or disprove a relationship between the variables?

Would your experiment be safe and ethical?

Is there a simpler or more precise way to state the hypothesis? If so, rewrite it.

What will you use to measure or evaluate the effect on the dependent variable?  
In the corn growth experiment we could use plant height measured daily to determine the rate of growth.

### **What If the Hypothesis Is Incorrect?**

It's not wrong or bad if the hypothesis is not supported or is incorrect. Actually, this outcome may tell you more about a relationship between the variables than if the hypothesis is supported or correct. You may intentionally write your hypothesis as a null hypothesis or no-difference hypothesis to establish a relationship between the variables.

For example, the hypothesis:

The rate of corn plant growth does not depend on the duration of light.

... can be tested by exposing corn plants to different length "days" and measuring the rate of plant growth. A statistical test can be applied to measure how well the data supports the hypothesis. If the hypothesis is not supported, then you have evidence of a relationship between the variables. It's easier to establish cause and effect by testing whether "no effect" is found. Alternatively, if the null hypothesis is supported, then you have shown the variables are not related. Either way, your experiment is a success.

### **Hypothesis Examples**

Need more examples of how to write a hypothesis? Here you go:

(Think about how you could test these.)

If you turn out all the lights, you will fall asleep faster.

If you drop different objects, they will fall at the same rate.

If you eat only fast food, then you will gain weight because your body will store the extra calories as fat.

If you use cruise control, then your car will get better gas mileage because your speed will be more consistent.

If you apply a top coat, then your manicure will last longer.

If you turn the lights on and off rapidly, then the bulb will burn out faster.