Science Fair Hypothesis & Project Examples

Hypothesis

After having thoroughly researched your question, you should have some educated guess about how things work. This educated guess about the answer to your question is called the hypothesis.

The hypothesis must be worded so that it can be tested in your experiment. Do this by expressing the hypothesis using your independent variable (the variable you change during your experiment) and your dependent variable (the variable you observe-changes in the dependent variable depend on changes in the independent variable). In fact, many hypotheses are stated exactly like this: "If a particular independent variable is changed, then there is also a change in a certain dependent variable."

Example Hypotheses

- "If I open the faucet [faucet opening size is the independent variable], then it will increase the flow of water [flow of water is the dependent variable].
- "Raising the temperature of a cup of water [temperature is the independent variable] will increase the amount of sugar that dissolves [the amount of sugar is the dependent variable]."
- "If a plant receives fertilizer [having fertilizer is the independent variable], then it will grow to be bigger than a plant that does not receive fertilizer [plant size is the dependent variable]."
- "If I put fenders on a bicycle [having fenders is the independent variable], then they will keep the rider dry when riding through puddles [the dependent variable is how much water splashes on the rider]."

Note: When you write your own hypothesis you can leave out the part in the above examples that is in brackets [ ].

Cause & Effect or Correlation?

In some experiments it is not possible to demonstrate that a change in the independent variable **causes** a change in the dependent variable. Instead one may only be able to show that the independent variable is related to the dependent variable. This relationship is called a **correlation**. One of the most common reasons to see a correlation is that "*intervening* variables are also involved which may give rise to the *appearance* of a possibly direct cause-and-effect relationship, but which upon further investigation turn out to be more directly caused by some other factor" (Wikipedia, 2006).

Is it OK to Disprove Your Hypothesis?

Is all science accomplished using this same method that is taught in schools and emphasized at science fairs? Should you worry if you end up disproving your hypothesis? Actually, the answers are no it's not, and no don't worry if you disprove your hypothesis.

Biodiversity Survey Project – Experiment/Study/Invention Example

Survey your area to find out which species of plants and animals live there. You might be surprised to find out that something you grew up thinking was very common, is actually quite unique! For example, you may think that marmots are a nuisance or a pest. Actually, some species are only found here, and have a very important role for short and tall grass ecosystems. The marmots are an important part of the food-chain, and are preyed upon by owls, falcons and eagles. You can conduct an experiment to count marmot populations in your area. By counting the number of marmots you see in a smaller area, you can estimate the number of marmots in the region. There are many other examples of local species in the Okanagan that are quite unique, use a field guide to help you identify a noteworthy species in your area. Remember that plants can be special too!

How to make this an even more interesting Science Fair project:

- Test an hypothesis – do you expect there to be more marmots in certain areas (habitats)? Why would the marmots like one type of habitat over another? What are the threats to their habitat and how might that affect how many marmots are living in the area?
- Invent a better way to find out how many marmots are living in your area.
- Suggest how to better protect marmot habitat – what are the key habitat features needed by marmots and how can we ensure they are available?

Going Green as You Clean: Are 'Green' Detergents Less Toxic Than Conventional Detergents? – Experiment Example

In this environmental science experiment, you will compare the **toxicity** of "green" (those asserting they are environmentally friendly) and conventional dishwashing detergents by measuring their effects on worms.

Materials and Equipment

- Styrofoam™ cups, 12-oz. size (84); you will need fewer if you reuse the cups.
- Permanent marker
- Liquid dishwashing detergents (2 "green" and 2 conventional)
- Plastic container (clean and reuse for each detergent)
- Plastic spoons
- Graduated cylinder
- Syringe
- Red worms; available at any bait store Other kinds of worms can be substituted, if you choose. You will need 28 worms per detergent.
- Toothpicks
- Potting soil (1 bag)
- Paper towels
- Kitchen scale, metric
- Aluminum foil
- Newspaper
- Lab notebook
- Graph paper
    - Performing the procedure with four detergents, with three trials of each (suggested in order to obtain accurate and repeatable results), you will need a total of 336 worms.

Experimental Procedure

Important Notes Before You Begin:

- Because this science fair project involves working with living organisms, namely worms, there will be some natural variability in the starting materials. You will need to be flexible and creative in carrying out the procedure. You should be prepared to adjust the procedure, as needed, to ensure that the results are due to the detergents being tested and not variations in the worm's conditions. Allow time to repeat the procedure for each detergent, for a total of at least three trials.
- The following procedure outlines the steps for a single detergent. Repeat these steps for each detergent you test.
- **Control** worms are those not exposed to *any* detergent. The other worms will be exposed to different concentrations of detergent.
- Talk with the worm supplier about the best way to store the worms as you perform the experiment.

Making a Dilution Series of Each Detergent

1. Label Styrofoam cups with the name of the liquid detergent and the percent concentration, as follows:
    a. Detergent Name: 0%
    b. Detergent Name: 3%
    c. Detergent Name: 6%
    d. Detergent Name: 12.5%
    e. Detergent Name: 25%
    f. Detergent Name: 50%
    g. Detergent Name: 100%
2. It is very important to thoroughly mix the detergent solutions before diluting them in the steps outlined below. Pour one of the detergents into the plastic container and mix it by stirring with a clean plastic spoon. Avoid forming bubbles.
3. In the cup labeled 100%, add 100 mL of liquid detergent.
4. In the cup labeled 50%, add 100 mL of liquid detergent and 100 mL of water.
5. Stir gently, but thoroughly, with the plastic spoon to mix the water and detergent.
6. In the cup labeled 25%, add 100 mL of 50% detergent (made in the previous step) and 100 mL of water. Stir to mix.
7. In the cup labeled 12.5%, add 100 mL of 25% detergent and 100 mL of water. Stir to mix.
8. In the cup labeled 6%, add 100 mL of 12.5% detergent and 100 mL of water. Stir to mix.
9. In the cup labeled 3%, add 100 mL of 6% detergent and 100 mL of water. Stir to mix.
10. In the cup labeled 0%, add 100 mL of water.
11. Cover the cups with plastic wrap to avoid evaporation.
12. Repeat steps 1–11 with clean materials to create the dilution series for each detergent.

Exposing the Worms to the Detergents

1. Poke several holes with a toothpick in the bottom of seven empty Styrofoam cups.
2. Label the cups with the name of the detergent, the date, and the percent detergent, as follows:
    a. Detergent Name, date, 0%
    b. Detergent Name, date, 3%
    c. Detergent Name, date, 6%
    d. Detergent Name, date, 12.5%
    e. Detergent Name, date, 25%
    f. Detergent Name, date, 50%
    g. Detergent Name, date, 100%
3. Add 100 grams (g) of potting soil to each cup. Use the kitchen scale to measure 100 g. You might want to put down a piece of paper towel on which to measure.
4. Add 5 mL of liquid from the dilution series to the appropriate cup.
5. Mix the detergent into the soil with a clean spoon.
6. Add four worms to each cup.
7. Cover the cups with aluminum foil and store them in a cool area, away from direct sunlight or hot air from a heater vent.
    a. Follow the worm supplier's directions about the best way to store the worms for the duration of the experiment.
    b. If the room temperature is very hot for part of the day, store the worms in a refrigerator until the room temperature cools off.
    c. Make sure that the soil stays moist and the temperature does not get too high.
    d. It might be necessary to keep the worms in the refrigerator for the entire duration of the experiment. (Check with your family before putting the worms in the refrigerator.)
8. Repeat steps 1–7 for each of the three additional detergents. You should have 28 cups with worms in them when this section is completed (seven for each of the four detergents).
9. You can either empty and discard the cups full of the dilution series, carefully and thoroughly wash them out to reuse for your second and third trials, or store them in a safe place to reuse for your second and third trials.

Analyzing the Effects of the Detergents on the Worms

1. After five days, pour the contents of the cups, one at a time, onto a surface covered with newspaper. Make sure to keep track of the detergent and dilution for each batch of worms.
2. Record how many worms are alive or dead for each detergent and dilution in your lab notebook.
3. Graph your results. Put the strength of the detergent on the x-axis, in percent, and the number of dead worms on the y-axis.
    - *Note:* All of the control worms should be alive. If they are not, you may need to shorten the period of exposure, or try alternative soils.
4. Compare the "green" detergents with the conventional detergents. Are "green" detergents better for the environment than conventional detergents?

5. Repeat the entire procedure so that you have at least three trials for each detergent. You can reuse the set of dilutions that you made in the first step in different trials. Remix each one a little before reusing; be sure to use a different plastic spoon for each detergent. Repeating the procedure ensures that your results are accurate and repeatable.

Variations

- Vary the concentrations and times of exposure to collect additional data.
- Determine the dose that kills 50 percent of the worms. This is referred to as the *LD50* (stands for *lethal dose for 50 percent of a population*). You will need more worms per dose.
- Instead of just looking at "alive" vs. "dead" worms, devise a scale for measuring the effect of the detergent on the worm's activity level. For example: 1) Same level of activity as untreated worms; 2) Low level of activity; 3) Very low level of activity. Graph your results.
- Test the ability of the detergents to block seed germination. See the Science Buddies project How Do Roots Grow When the Direction of Gravity Changes? for a procedure about germinating seeds. Use the detergent dilutions made in the procedure above.