Module 1: Fundamentals of Biology
Topic 2 Application: Scientific Investigation Design

What question do you have that you would like to find the answer to scientifically? Normally, thinking about one scientific question leads to several questions that you could test with an experiment. This is what makes science so challenging, intriguing, and fun!

In this assignment, you will design your own experiment based on a question or problem that needs to be solved. Before you begin this assignment there are a few helpful hints that you will want to consider so that you pick the proper question and design an experiment that answers your question!

> Make sure your experimental question can be answered by experimentation. Questions like, "How does fertilizer affect the growth of plants?" or "Which type of insulating cup keeps hot chocolate the warmest?" are great questions. However questions like, "Why does evil exist in the world?" or "Is it ethical to hunt elephants?" are not appropriate for science because no specific tests can be performed to give answers.

Introduction

In the introduction of your experiment, you will need to explain the purpose or question behind your experiment. You will need to perform as much research as you can so that you can provide an introduction that explains the principals behind the experiment, and reasons for performing the experiment.

Objectives

The objectives of the experiment should be concise statements that explain what will be explored in the experiment. There is no specific number of objectives in an experiment. When writing objectives you need to make sure your objectives answer your experimental question or purpose. You will want to start your objectives with the statement:

The purpose of this scientific investigation is to…

Hypothesis

Hypotheses are presented in "if...then" statements. Notice the detail in this example, "*if plants are provided nitrogen-based plant fertilizer, then they will experience more growth than plants receiving water only.*"

Procedure and Data Collection

The procedure of the experiment needs to be a series of instructions so that anyone can repeat it. It is very important that you include all details about the experiment and its set-up. Any person running this experiment after you will need to know everything that you did. Be very specific in this section of the report.

> A good experiment will have identified the variables while keeping constants, or controlled variables. It is important to remember that the best experiments only test one independent variable at a time, while keeping all other variables constant while using a control group. Make sure your dependent variable is clearly measurable. The height of plants is measurable. The health of a plant is not clearly measurable; can you see the difference?

When designing your experiment, make sure you include repeated trials in your experimental design. Repeated trials reduce the chance of random error or variations that can occur.

Equipment and Materials

Make a list of all of the materials that someone conducting the experiment would need. Be very specific.

Data

You will need to record findings, or data, in this section. It is best to create an appropriate data table to record the findings when you are experimenting.

Data Analysis

In this section you will need to create a graph or chart to present the findings you recorded in your data table(s). Data should be both recorded and presented in proper scientific reports.

Conclusion

In the conclusion, you need to write an overall conclusion based on your data. Look back over your experiment and ask if your hypotheses are true or false. How do you know? Use the data and notes that you collected from your experiment to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

In this section, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?