DESIGNING YOUR EXPERIMENT

Simplicity

Keep things as simple as possible. Many students think that they need to have many variables in an experiment to make the experiment valid. This is not the case. It's much better to test only one variable thoroughly than to test many at once. For example, if you're investigating the effects of freezing temperatures on tropical plants, don't add different lighting sources and nutrients as well. Only look at the effect of freezing temperatures.

Controls

All experiments need to have an appropriate control. You need to have a standard to test your experimental results against. For example, if you're studying the effect of freezing temperatures on tropical plant growth, you will probably put some of your plants outside for a few cold nights. When you take them back in your house to see how the cold affected their growth, you'll need to have some plants that were not exposed to those cold temperatures to compare them to. The plants that did not see the colder temperatures are called a "control". All experiments must have controls and it's worth taking time to figure out what a good control would be for your experiment.

Sample Size

You will need to have several "subjects" in your experiment. For example, back to the effects of freezing temperatures on tropicals, you'll need to set several plants out in those temperatures, not just one.

Time

Allow enough time for the experiment to be repeated. Also, allow enough time for complications- things don't always (if ever) go right the first time and you might need to start your experiment over again. Begin early! Understand the project before you begin, and allow 6-8 weeks to complete the experiment.

Keep a detailed notebook

- Don't cross anything out, you might need to refer back to it later.
- Entries should be dated with the date and the number of days into the experiment.

Include all observations don't assume you'll remember points and particulars. What might not seem important at the time might be an important result later and might actually support your conclusion, so you'll want an accurate record of it.

Collecting data

Quantify your results by reporting things in numbers, not just observations. For example, say that your plants grew 1 centimeter. Don't say that the plants "look bigger today than they did yesterday". Words like "bigger" mean different things to different people, so reporting your results using words can lead to confusion. You want to tell people exactly how much your plants grew.

Formulating a conclusion

Did your data support your hypothesis? If not, that's a result too. It doesn't mean that the experiment didn't work. Also, consider other possible explanations for your results. Did your treatment kill your plants or was it that you left them outside and some insects ate some of the leaves? You're not out to "prove" your hypothesis. Think more along the lines of "here's what I thought was going to happen and here's what actually happened" and then go on to explain why you think it happened the way it did.

The Final Presentation: Tips For the Science Fair

There are several essential elements to a good presentation:

- Present your data using averages, not individual measurements. Also, don't present the data more than once. Don't make a line graph and pie chart of the same data. Finally, don't include more than one variable on a graph or it gets confusing.
- Report sample size (n=?). Older students should give some statistical analysis of their data, such as standard deviation, anova or t-test.
- Have print large enough to read from a distance.
- Be sure that you understand all the terms and acronyms you present.
- Think about future experiments and how you could expand on a project. Many students do science fair projects in consecutive years. You should think about expanding and significantly changing your project, not just repeating the same project.