WRITING A SCIENCE FAIR ABSTRACT

Writing a good abstract for a project is really not difficult. There are just some pointers to keep in mind, and some pitfalls to avoid.

- It should state clearly and understandably **what you did**. It should not be in future tense, but rather a description of the actual project. This is the difference between a research plan and an abstract.
- It should include all important quantitative conclusions. If you found that the energy content of matter is proportional to the square of the speed of light ($E=mc^2$), *say so!* The reader should have a pretty good idea what is interesting about your project after reading the abstract.
- BUT, it should not include detailed descriptions of procedure, nor, in most cases, detailed lists of results. Decide what is **important**, and summarize as clearly as possible.
- Avoid also extensive background material. That is appropriate in a report, but not in the abstract. A good rule of thumb is that one short sentence of background is appropriate, and even that only if it is necessary to understand the significance of the project.
- Remember that the abstract will be published, with only minimal editing. Check it over for grammar and style, as well as for meaning.

The important thing to remember is that the abstract is the first contact that most people (including the judges) will have with your project. Make it clear and to the point, avoiding unnecessary detail, but including any important conclusions. If you could have written your abstract before starting the project, it probably isn't sufficiently informative.

The attached samples may give you some ideas as to the appropriate style to use. The abstract is an important part of your project. Write it with care.

REMEMBER!----

- **all projects must have abstracts submitted via our online system by March 9.** You must login on our website, http://njrsf.org, click on Students, and follow the links for the Entry Status screen and then for abstract submission. This must be done at least once for each project. If you submit more than once, the latest one will be used.
- If you withdraw, you must notify us by March 8 in order to obtain a refund of your entry fee. If you notify us later than March 9 your name will appear in the printed program for the fair.
- Make sure you fill out the supplemental registration form on the website. It is accessible from your Entry Status Screen, and from the Student menu.

NOTE THE FOLLOWING DISPLAY RULES

- YOU MUST LET US KNOW IF YOU NEED POWER. In our layout this year, we are planning on having power only to those projects that need it, and therefore we must know IN ADVANCE whether you need power. The power requirement of your project is noted on your confirmation form. Make sure it is correct!
- PROJECT IDENTIFICATION PLAQUES. You must reserve space on your backboard for a 4x6 card that will contain your project number. This space must be in the upper left corner of the center panel of your display board (i.e.: not on a wing, if your display board is hinged). We are trying to standardize the display of the numbers this year, because judges have in the past had some difficulty locating projects, and also because the power requirements (above) will necessitate splitting the categories. We will supply this card, to be attached to your project after safety review.

SOME EXAMPLES

Here are some samples drawn from recent abstracts submitted. We show the abstract as submitted, then make comments and show a revised version.

Acid Rain: The Silent and Deadly Killer

> The subject of my experiment is acid precipitation and its effects on the freshwater environment. I set up a control tank and an experimental tank, adding drops of 6M nitric acid to the latter to lower the water's pH. After four days the experimental tank's water fell from a pH of 6 to 4. On each day, I took samples from each tank and counted the number of Euglena, Closterium, and Rotifer in a given area (1.5x0.5 cm). This process was done 15 times for each tank on each day to insure accuracy. The average of each of these 15 times was then substituted into a proportion to approximate the population of the organisms in each tank. When the experiment was completed, I had proved that by lowering the pH of the water, the population of each organism I had observed did decrease severely.

This is a good abstract, but you'll note that there is too much detail at some points. The concentration of the acid or the number of times a reading was averaged is immaterial to the issue of what the project is about. An improved version might read as follows:

> The subject of my experiment is acid precipitation and its effects on the freshwater environment. The buildup of acid rain in a body of fresh water was simulated by artificially lowering the pH of an experimental water tank, and comparing the population of various microbes in samples from that tank and from a control tank which remained at a pH of 6. Populations of Euglena, Closterium, and Rotifer were monitored as the pH of the experimental tank was lowered to 4 over a period of four days. The results show that all three populations were adversely affected by the reduction in pH.

The abstract might be further improved by a quantitative statement of the results, such as, "Each of the three test populations decreased by at least 70% over the course of the experiment, while those in the control tank fluctuated no more than 10%."

Example 2

Nitonol: Miracle Metal of the 80's

> The purpose of my research with Nitinol is to show and/or find out if it is less expensive and more practical to use in such things as machinery (Ball Bearings) and robotics (hot/cold water systems). Nitinol is a shape memory metal. When nitinol is heated it changes to the original and/or programmed shape. I have constructed and designed a robotic hand, using nitinol wires. The nitinol wires have been placed in the fingers. When hot water is passed through the hand the wires curl up and make the hand close. I feel this could be used in robotics under a hot/cold water system.

This example could benefit from less background and more quantitative information as to the performance of the hand.

> I have constructed and designed a robotic hand, using wires of nitinol, a shape memory material which is activated by heating. Nitinol wires in the fingers cause the hand to curl up when hot water is passed through the hand. With a water temperature of 75°C, a finger movement of 5 cm is obtained for the model employed here (overall length: 16 cm).

Example 3

Optical Absorption Studies of the Copper Atoms in Cytochrome c Oxidase in Mitochondria

Cytochrome c oxidase is the last enzyme in the respiratory chain, which uses oxygen to make water with the production of energy. A fundamental principle of biology is that the structure of a molecule is related to its function. This enzyme contains two iron atoms and two copper atoms. Much of its biochemistry is known. What is still unknown is the function of the copper atoms. This project was undertaken to determine the role of the copper atoms. The copper absorption lies in the optical and infrared regions. Using the variables of low temperature and selective reduction, we can distinguish the contribution of each copper atom. Copper contributions were observed during respiration and these results showed that the copper atoms behaved the same as in a purified cytochrome c oxidase preparation. One copper and one iron atom are reduced together by the first two electrons, then the other iron and copper atoms are reduced together by the next two electrons. These four electrons reduce O_2 to $2H_2O$.

Again, a good abstract, but almost half of its length is devoted to background information. The important point here is to decide how much of this background is important to the understanding of the point of the project. This is clearly a subjective decision, and one person's answer might be the same as anothers. In this case, somewhat more might be appropriate, although the version given above can certainly be condensed as follows.

Cytochrome c oxidase is the last enzyme in the respiratory chain, reducing O_2 to $2H_2O$. Although much of the biochemistry of this molecule is understood, the function of its two copper ions remains obscure. We have studied the optical absorption due to those ions. Our first finding was that the contribution of each copper ion in the pair is distinguishable in this spectrum. Observations during respiration showed that the copper ion behavior is the same in that case as in a purified preparation of cytochrome c oxidase. The results show that one copper and one iron ion are reduced together by a first pair of electrons, while a subsequent pair reduce the remaining ions.

Example 4

Effect of Aspartame on Intestinal Neurotransmitter Serotonin: How it Influences Food Consumption in Mus Musculus

It is a recent theory that aspartame may actually increase hunger, therefore being of no use to people trying to control their weight. I hypothesize that aspartame inhibits the production of the neurotransmitter serotonin, and thus increases or maintains a subject's hunger, potentially causing a gain in weight. I will attempt to prove this hypothesis by comparing the weight gains of mice given 5 ml of a .5% aspartame solution daily with those of mice given 5 ml of only tap water daily. The urine will also be tested to determine whether aspartame is actually blocking the production of serotonin to some extent and consequently causing a weight gain.

This abstract is written as a research plan. The ideas are good, but what was actually done? The reader cannot tell from this abstract. Putting in some information on the actual project, we might obtain the following:

Recent research has suggested that aspartame, used presently as an artificial sweetener, may actually increase hunger sensations. I have tested this possibility by comparing weight gains of mice receiving daily doses ($25\mu g$) of aspartame with those of mice receiving only a placebo dose. Both groups were fed all they would eat. The results demonstrate conclusively (chi square confidence level of 95%) that the aspartame increased the weight gain of the experimental group by at least 15%. A concurrent experiment was attempted to measure serotonin levels in the urine of the two groups, since an effect on serotonin production is one possible mechanism for the influence of aspartame. Results of the latter experiment were inconclusive.

Note that there is nothing wrong with identifying an inconclusive result as just that! Not everything is going to work.

Example 5

> The purpose of this experiment is to verify the Gough-Joule relationship, which expresses the effect of temperature on a length of stretched rubber. The apparatus is designed to run at two constant temperatures: that of cold tap water and that of steam. From stress-strain measurements, the relationship may be verified. While experimenting with two types of rubber bands from Plymouth Co., I discovered that an inferior brand in fact held up much better under these conditions than did a "superior" American brand.

This abstract fits most of our criteria. It gives sufficient but not extensive background, describes what was done, plus giving an interesting conclusion. The mention of Plymouth Co. is probably unnecessary, and additional quantitative statements as to what is meant by "much better" could be added.

All of the projects accompanying the above abstracts have taken awards in past years. Nevertheless, there is always room for improvement, The abstract is an important facet of your project. You will have already invested considerable time in your work toward your project. You should take the care to see that that work is adequately reflected in the abstract you submit.