CHOOSING A SCIENCE FAIR PROJECT

The project that you choose will fall into one of a number of scientific categories and may be an experiment, study or invention/innovation. When your project is complete, it will be entered into the Science Fair where it will be grouped along with other students in the same scientific area of the same age. The groupings are: **Junior** Grades 7 and 8; **Intermediate** Grades 9 and 10; **Senior** Grades 11 and 12. Grades 4-6 are encouraged to enter a project for the non-competitive fair as it's a fun way to learn about a science topic that interests them and a great chance to practice for entering a project when they can compete at the Junior level.

Information in this handout was collected from these great websites – check them out for more info!
www.sciencebuddies.org www.sciencefairs.ca/students
http://steppingup.ysf-fsj.ca/index.php/Main_Page
http://www.sciencefairs.ca/assets/18/AMP_-_Guide_to_Completing_Your_Science_Fair_Project_24_Nov_2010.pdf

TYPES OF PROJECTS

Experiment: an investigation undertaken to test a specific hypothesis using experiments. Experimental variables, if identified, are controlled to some extent. An outstanding experiment devises and carries out original experimental research which attempts to control or investigate most significant variables. This would include statistical analysis in the treatment of data.

For example: Can Windex kill cancer cells?

Study: a collection and analysis of data to reveal evidence of a fact, situation of scientific interest. It could include a study of cause and effect relationships or theoretical investigations of scientific data. An outstanding study synthesizes information from a variety of significant sources which may illustrate cause and effect or original solutions to current problems through synthesis. It identifies significant variables with an in- depth statistical analysis of data.

For example: The mysteries of the Bermuda Triangle revealed! Ship disappearances correspond to giant jellyfish migratory routes.

Innovation / Invention: the development and evaluation of innovative devices, models, techniques or approaches in technology, engineering, or computers (hardware or software). An outstanding innovation integrates several technologies, inventions or designs and constructs an innovative technological system that will have human and/or commercial benefit.

For example: The invincible rubber car – it will never crash!

The originality of your project is extremely important as well. An outstanding project is highly original or has a novel approach to an existing question. The project should show resourcefulness, creativity in design and the use of equipment and/or construction of project.

EXHIBITION CATEGORIES

Biotechnology and Pharmaceutical Sciences

A Biotechnology project is the application of biological systems to solve a problem, create a product or provide a service. Biotechnology projects will fall into one of three subject fields: crop development, animal science and microbials. Pharmaceutical sciences projects study the interaction of chemical substances with living systems. Substances with medicinal properties – the potential to cure or reduce symptoms of an illness or medical condition – are considered pharmaceuticals. Projects could include studies on drug composition and properties, interactions, toxicology, therapy, medicinal applications and antipathogenic capabilities.

Computing and Informational Sciences

Computing and information technology projects concentrate primarily on the development of computing hardware, software or applications, including programming languages and algorithms, software design and databases as well as the storage, transmission and manipulation of information.

Projects using computers to store and analyze data are normally entered in the division suggested by the focus of the experiment or study. However, if the project's focus is primarily on the application of computing to the problem and the data are of secondary significance, the project should be entered in this division.

Earth & Environmental Sciences

Earth and environmental sciences projects focus on topics relating to planetary processes, the relationship of organisms to those processes, or the relationships between or among organisms.

Projects in this division can include issues in any of the following scientific disciplines: geology, mineralogy, physiography, oceanography, limnology, climatology, seismology, geography, and ecology. Earth and environmental sciences includes the study of pollution, its sources and its control. It can also involve studies of biotic and/or abiotic factors in an environment, where such studies enhance our understanding of biological relationships and abiotic cycles.

Studies dealing with resource management or sustainable development usually fall into this category. Examples of such studies might include capture/recapture studies estimating population densities, determining bioproductivity in a specific ecosystem or niche, plate tectonics studies or examinations of mineral cycles (e.g., salt mills in the oceans).

Engineering Sciences
An engineering project applies physical knowledge to solve a problem or achieve a purpose. A complete engineering project will include an outline of the need, the development of the innovation and some work on introducing the innovation to the community; however, many engineering projects focus on just the development phase.

Engineering projects normally focus on a new process, or a new product. A study of Bernoulli's principle would be Physical Science, while the application of such a principle to improved aerodynamics and wing design would be engineering.

Health Sciences
A health sciences project examines some biomedical and/or clinical aspect of human life or lifestyle and its translation into improved health for humans, or more effective health services and products. Projects related to the health of specific populations, societal and cultural dimensions of health, and environmental influences on health are also included in this division.

Health sciences projects include those related to human aging, genetics, cancer research, musculoskeletal health, arthritis, circulatory and respiratory health, nutrition, neurosciences, mental health, psychology, metabolism, human development, infection and immunology.

Projects involving animal research that have a direct application to humans are included in this division.

Life Sciences
A life science project examines some aspect of the life or lifestyle of a non-human organism.

Life science projects include botany and zoology, as well as psychology and kinesiology of non-human organisms. Examining plant growth or animal behaviour are examples of life science. Some phenomena, such as digestion, involve both life science and physical science. The selection of division will spend on whether the young scientist's intent was to study the chemistry of the process, or the role of the process in the life of the animal (eating, production of enzymes, handling of wastes, etc.)

Physical & Mathematical Sciences
A physical and mathematical sciences project studies abiotic phenomenon to understand the relation between identified factors, perhaps including a cause and effect relationship, or the use of mathematical models or mathematics to solve theoretical problems.

Physical science projects include fields such as physics, and chemistry and astronomy. Comparison testing of products is included in this division.

Mathematical science projects seek to demonstrate applications of mathematics (i.e. the search for a mathematical model) or to solve a theoretical problem. For example, in attempting to predict the shape of cacti, the use of mathematics would be central to the project. The problem provides a context for the exploration of pattern and the search for a mathematical model. Some areas of investigation in this category include algorithms, operational research (applications of mathematical and computing science to solve planning or operational problems), and statistics.

Automotive Sciences – An Interdisciplinary Category
At the Canada-Wide Science Fair, projects will be entered as one of the above seven categories but may also qualify for the Interdisiplinary Automotive Sciences Category. Projects in this interdisciplinary category deal with one of six key research themes:

- Health, safety and injury prevention
- Societal issues and the future automobile
- Materials and manufacturing
- Powertrains, fuels and emissions
- Design processes
- Intelligent systems and sensors

Where to start your project?

Research your Topic: Read books from the library; observe related events; gather existing information; look for unexplained or unexpected results. Talk to professionals; write to companies; and obtain or construct needed equipment. Look up companies in the phone book under your topic of interest and you may find lots of people who'd be happy to tell you about what they do and give you ideas about what to for your project. Watch science-related TV shows or visit websites like the Canadian Geographic Society, National Geographic, Discovery Channel, the Nature journal.

Organize and Theorize: Organize your research. Narrow down your hypothesis by focusing on a particular idea.

Make a Timetable: Choose a topic that can be done in the amount of time you have. Identify important dates (e.g. the Science Fair! April 9-10). Allow plenty of time to experiment and collect data. Leave time to write a paper and put together an exhibit.

Plan your Experiment, Study or Innovation: Write a research plan to explain how you will do your experiment.

Consult your Teacher/Supervisor/Mentor: Discuss your work with an adult on an ongoing basis.

Conduct Your Experiments, Study, or Innovation: Keep detailed notes of every experiment, measurement, and observation in your data log. Change only one variable at a time when experimenting. Include control experiments in which none of the variables are changed. Include sufficient numbers of test subjects in both control and experimental groups.

Examine Your Results: When you complete your experiments, examine and organize your findings. Did your experiment give you the expected results? Was your experiment performed with the exact same steps each time? Are there other causes that you had not considered or observed? Were there errors in your observations? If possible, analyze your data statistically.

Draw Conclusions: Which variables are important? Did you collect enough data? Do you need to conduct more experimentation?

But wait! How am I going to be able to do an experiment without a lab or technical equipment?

For many students, obtaining access to equipment beyond what is offered in their schools is a big challenge. For the most part, equipments found in your home kitchen and garage is sufficient. In fact, it is almost preferred that you construct your own equipment as this shows that you understand the whole process of what you are measuring and how the measurement is done. If you use more high tech equipment, the process of measurement is hidden. All you have to do is put in a sample, and the machine will spit out a number. Judges at science fairs often encounter a situation where they see a very well made poster with flawless data analysis, but when asked, the student does not understand what values were actually measured and what that meant. This would lead the judge to think that the student doesn't completely understand his/her project.

On the other hand, some projects just can't be completed with homemade equipment. In this case, students need to gain access to professional equipment, most likely at a university. Many students are afraid to approach professionals and professors. To students, these people seem like a whole different species of animal. Actually, most of them are very friendly and approachable. One student obtained access to a viscometer in a university lab. When I asked him how he approached the professor, he replied: "I simply phoned them and they are extremely nice so they agreed :D " (the smiley face was part of the original text)

You're also welcome to ask the staff at the Science Centre for advice – we just might have the tools to help or if not us we'll know someone else who does!

What do I need to present at the Science Fair?

1. Abstract

An abstract is written once your research and experimentation are complete. It should include a statement of the problem/purpose of the experiment, the procedures used, your data and your conclusions. For the Canada-Wide Science Fair, your abstract must not exceed five double-spaced typewritten pages. Check locally for requirements of your regional fair. Abstracts are distributed to the judges to familiarize them with the project. The abstract is evaluated as part of the project. Project Data Book: A project data book should contain accurate and detailed notes to demonstrate consistency and thoroughness to the judges and to assist you with your research paper.

2. Project Data Book (Log)

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3. Research Paper

A research paper includes the following:

- **Title Page**: Centre the project title and put your name, address, school and grade at the bottom right.
- **Table of Contents**: Include a page number for the beginning of each section.
- Introduction: Includes your hypothesis, an explanation of what prompted your research and what you hoped to achieve.
- **The Experiment**: Describe in detail the methodology used to collect your data or make your observations. Include enough information for someone to repeat the experiment. Include detailed photographs or drawings.
- **Discussion**: Thoroughly discuss exactly what you did in your project. Your results should be compared with theoretical values, published data, commonly held beliefs and/or expected results. A discussion of possible errors should be included as well as how the data varied between repeated observations, how your results were affected by uncontrolled events, what you would do differently if you repeated the project, and what other experiments should be conducted.
- **Conclusion**: A summary of your results.
- **Acknowledgements**: Credit individuals, businesses and educational or research institutions which assisted you. Identify financial support or in-kind donations.
- **References/Bibliography**: List any documentation that is not your own (ie books, journals articles). Different kinds of sources (books, encyclopedias and dictionaries, magazine and newspaper articles, and websites) will require different citation format. Check out Sciencebuddies.org for examples of citation formats and info on how to make a bibliography.

And last but definitely not least…you need a **DISPLAY**…

4. Display

Your project display should be designed in order to should attract people to your work and to inform them in an easily digestible manner. This means providing a clear illustration of the project and results. The display should include **headings that stand out**, **posters** containing written material and **charts**, clearly drawn and correctly labeled **graphs and diagrams**, and if applicable some of the apparatus used so that key aspects of the project can be demonstrated. Use bright colours or bold black and white layouts. A backboard is used to display your posters/figures and must meet the Canada-Wide Science Fair requirements.

The Canada wide Science Fair maximum size restrictions:

1.2 metres wide

0.8 metres deep

3.5 metres high from the floor

See this website for directions on how to make a cool display using pipes – light and easy to transport!

http://www.sciencefairs.ca/students/display/