SAB WORKSHOPS:
GREATER SAN DIEGO SCIENCE AND ENGINEERING FAIR

SCIENCE FAIR PROJECTS - THE STEP BY STEP PROCESS:

- Why do a science fair project
- Choice of topic, planning, approaches
- Projects to avoid
- Experimentation
- Results, analysis, conclusions
- Writing the report, building the display
- Presentation

Why do a Science Fair Project?

* They're a big plus on college, scholarship and job applications
* They provide opportunities to:
* Create self-esteem through scientific literacy
* Work across the curriculum
* Conduct independent research
* Utilize scientific method
* Develop writing skills
* Employ mathematical and analytical skills
* Give oral presentations
* Find the answers to your own burning questions
* Carry an idea through to completion
* Work to deadline
* Respect humane and safety considerations
* Document procedures
* Create artistic displays
* Interview and work with professional scientists and engineers
* Defend their work in interviews with judges

Participation in Science Fair:

- Helps develop research, planning, communication, presentation and overall scientific skills.
- Boosts confidence.
- Opens the door to many other competitions — local, state, national and international
- Helps decide careers
- Science fairs allow for interaction with students from throughout San Diego and Imperial counties and, in the case of other competitions, from around California, The United States and the world,
- Make connections with scientists through partnerships and internships and,
- Provide opportunities to meet Nobel Laureates

Why do a senior category project?

One big plus on college applications. Increased opportunities for scholarships, and for competing in other national and international competitions

* To quote some of our former exhibitors, the science fair is:
* "A Stimulating Experience"
* "A Competition in Which You and You Alone are Challenged"
* "The Greatest of Encouragement — Turns Dreams into Realities"
* "My Fondest High School Memory
* "Fun!"

Getting Started

<u>One of the most important tips to a good science fair project is time management:</u>

Planning and executing the work, and putting the project together including the display takes anywhere from 50-200 hours or more. So, plan ahead. Set mini-deadlines to space out the work.

In designing a science fair project, you need to start with research. Then take a "bird's-eye view" of the subject of interest before definitely deciding on the project question.

I. Research

A.**"I Don't Know What Topic to Choose" phase**

Begin to look for areas of your interest. Look for questions within that area that might be worth exploring.

Along with interest, you may also choose a topic that can benefit your community or society in general. Look around your community and try to find something that you can discover, study, design, create or improve that will solve a troublesome problem.

Don't be afraid to try something even though it might not work. Be creative. Sometimes the simplest solutions and the smallest contributions are the most important.

Begin your research by reading different printed science materials, performing exploratory investigations, asking questions of knowledgeable people, and

checking out information on the Web. From your research information, decide on a topic that you find interesting.

Read science magazines like *Science News* and *Scientific American* and research on the Internet to see what is currently being done in science. Always choose a topic that interests you and make sure whatever you choose is possible to do in time and with the equipment available.

Some very useful websites for tips, ideas and getting started (these websites even give sample projects:

http://www.school.discovery.com/sciencefaircentral/

http://sciencefairproject.virtualave.net/

http://members.aol.com/ScienzFair/ideas.htm

Useful magazines to read:

Scientific American

Nature

Science

Science News

American Scientist

National Geographic

Scientific Journals Sources:

Libraries at UCSD, SDSU

Talk to knowledgeable people. Talk to your parents, teachers, neigbors, other knowledgeable people. By talking you'll find out there's a lot of stuff out there you don't know. The elders may help you to narrow down your questions, tell you what is feasible and what is not. Your teachers may put you in touch with

people in the field of interest to you. You may also find someone to act as your mentor for support and suggestions.

B. Research Your Topic

Research what is already known about the topic. Narrow the topic to a specific scientific problem.

"I Have a Topic; Now What Kind of Problem Can I Solve?"

If your topic is plant pigments, find out as much as possible about them and write down questions:

1. Check out plant pigments on different Web sites.
2. Search books for information on plant pigments.
3. As you research, write down inquiring questions, such as these:

* How is chlorophyll produced?
* What is chlorosis?
* What effect does light have on the production of pigment in plants?

Select one of the inquiry questions that most interests you and proceed to the next step.

Hypothesis:

Can you state a hypothesis for the question? (A *hypothesis* is a guess about the answer to the question, but the guess must be based on facts. It must be something that is testable with measurable results.) Yes, a hypothesis can be stated for the inquiry question. (If the answer is *No, I cannot state a hypothesis for the question,* then reword the question or select another one).

Is your hypothesis testable and measurable?

Once you have a hypothesis, can you think of a way to test your hypothesis experimentally with measurable results? If the answer is no, then you need to reword your hypothesis or select another one.

Plan Your Experiments

Develop an experiment to solve the specific scientific problem you've chosen.

Write a Research Plan

* Write a detailed research plan describing how you plan to conduct your research:
* Develop a procedure.
- Obtain the appropriate approvals before starting your research.

Think about the experiment and ask yourself the following questions (applies to chemistry, biology, environmental sciences etc). If the answer to any of these questions is no, you need to redesign the plan.

1. Does it have *measurable* results (results that can be measured with an instrument or a set of criteria)?

2. Does it have an *independent variable* (variable being changed by the experimenter)?

3. Does it have a *dependent variable* (variable being observed that changes in response to the independent variable)?

4. Does it have a *control* (A set of conditions that include everything except the independent variable ?)

5. Does it include repetitive measurements?

Complete the Required Forms

Discuss the project with your parents and teacher. Review with them the International Rules as well as the specific rules that might apply to your type of research. For example, if you are working with human subjects or animals or hazardous substances, specific rules apply. **Complete the required forms for the local science fair (and ISEF) before starting**.

Finding mentors to work with:

It is not always required to work in a large institution with a specialist in your area of interest. Experiments can be set up at home. If your question requires equipment or chemicals that cannot be used or set up, or unavailable at home, try your school workshops and labs. Ask your science teacher for help. If that is not possible, contact researchers at scintific institutions. Finding these people is by no means easy, and success comes with some persistence. Don't be shy--call professors at local universities or even e-mail them. Getting an interview is

essential. The interview helps your mentor to assess you and see if your question is answerable and if you both are personally compatible.

Don't be afraid to seek help from several sources, including GSDSEF and SAB and to use the resources that are at your disposal.

PROJECTS UNLIKELY TO BE ACCEPTED -- AVOID!

(Even frequently done projects, assuming they have an original twist with exceptional thoroughness and solid scientific method, can have the depth needed for acceptance.)

First and foremost -- any project in violation of GSDSEF, ISEF or California education rules and regulations will not be accepted

OTHERS:

1. Effect of colored light on plants (or anything else)
2. Effect of music on plants (ditto)
3. Effect of talking on plants (ditto)
4. Effect of cigarette smoke on plants (ditto) -- NOW FORBIDDEN
5. Mold growth
6. Crystal growth
7. Effect of cola, coffee, etc. on teeth
8. Effect of running, etc. on blood pressure
9. Effect of music on blood pressure
10. Effect of video games on blood pressure
11. Effect of almost anything on blood pressure
12. Do we eat balanced diets? (data usually unreliable)
13. Strength/absorbency of paper towels (and other products)
14. Most consumer product testing of the "Which is best?" type -- approach generally without scientific merit
15. Graphology
16. Astrology
17. ESP, especially standard card test
18. Basic maze running
19. Any project which boils down to simple preference.
20. Effect of color on memory, emotion, mood, etc.
21. Effect of color on taste.
22. Effect of color on strength.
23. Optical Illusions
24. Reaction Times

25. Many male/female comparisons, especially if bias shows
26. Basic planaria regrowth
27. Detergents vs. stains
28. Basic solar collectors
29. Acid rain projects (Important: to be considered, thorough research into the composition of acid rain and a scientifically accurate simulation of it would be necessary.)
30. Basic flight tests, e.g., planes, rockets
31. Battery life (plug in and run down type)
32. Basic popcorn volume tests
33. Stills of any kind (PROHIBITED)
34. Pyramid power
35. Basic flower preservation techniques
36. Taste comparisons, e.g., Coke vs Pepsi
37. Smelling vanilla, etc., to improve test scores
38. Sleep learning
39. Taste or paw-preferences of cats, dogs, etc.
40. Color choices of goldfish, etc.
41. Basic chromatography
42. Wing, fin shape comparison with mass not considered
43. Ball bounce tests with poor measurement techniques

Conduct Your Experiments

Begin your experimentation following your research plan and any revisions recommended by the people supervising or approving your research. Investigate to test the hypothesis. Make observations and collect data in a project journal (a project journal/logbook is required). Interpret the data and observations.

Data

Data is the only way that a judge has to determine whether or not you did an experiment. Judges like to see tables, charts, or graphs of the measured results. Any project that has data generally gets an automatic second look by judges. If there is no data, judges start to look for the reason why, and they usually conclude that the student doesn't understand what an experiment is, or how to do one, or did not do the experiment in a systematic way.

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