Devotion's Ninth Science Fair

What is a science fair?

A science fair is a place students present their science projects and compete for prizes. Its main purpose is to get you excited about science by actually doing it rather than simply learning about it. A scientist first asks a question about some aspect of the world and then tries to find its answer. At the science fair, each student presents a project, both visually and orally, with the question and answer displayed in an interesting way. Students must also be able to explain their project and answer questions.

Some motivation: Why would you want to participate in the science fair?

A science fair gives you an opportunity to explore some part of the natural world. The subject does not have to be covered in school. The main criterion is that it should interest you. It gives you the chance to think and act like a scientist. When you were a baby, you did this all the time. You learned about the world by performing experiments. For example, you learned about gravity by dropping food off your high chair and learning that peas and peanut butter all fall to the floor. Much later, you will learn that they all fall at the same rate. Or, even though red and blue make purple, drawing with a red crayon on a blue wall does not result in a purple line.

Scientists make an impact on the world by finding answers to questions before anybody else does. Science is, in large part, a competition. Some scientists compete by finding answers faster than anyone else, while other scientists compete by asking new questions. The best scientists are the ones that remain curious about the world – they never stop asking questions and acting like babies! We hope that while working on your project, you will learn this by getting to talk to real scientists. Boston, Brookline, and Cambridge are full of scientists, many of whom will be more than happy to talk with you about your project.

Remember that it is not easy to do a science fair project. A good project takes a lot of time and effort, and you will be working mostly on your own. But we are pretty sure that you will enjoy spending the time, and that when it is over you will agree that it was worth the work!

What does it mean to think like a researcher, scientist?

You start thinking like a scientist when you ask questions:

- Why? You notice something, and wonder why it happens.
- What? You see something and wonder what caused it.

- How? You want to know how something works.
- When? You want to know when something happens or happened.

What is a good project?

1. You ask a question in a subject you are interested in - it's something you like to think about and will be happy to spend time working on. For example, we have a pet bird at home who is a very picky eater. What is its favorite food? Does it ever get sick and tired of eating the same food all the time?

2. You must figure out a way to find the answer to your question. There are many ways to answer such questions, here are some of them: by designing an experiment, or by building a model, or by writing a computer program.

3. You can do it mostly by yourself, with only a little help from grown-ups: parents, organizers, teachers and friends. The main reason to do a project is because it's fun and you will learn something you didn't know before. Having someone else help too much takes away some of your fun and you don't learn as much. Your project doesn't have to be perfect, just neat and following a scientific method. Don't be afraid to ask for help if you need it.

4. A good project is something you design and build by yourself from easily-obtained, everyday materials. Doing it by yourself is more satisfying than simply buying a kit someone else made in the store.

5. A good project will ask an interesting question and begin the work of finding an answer. After asking the question, you must then try to learn about the subject. You may present what you learned about the subject but a great project will be one that also finds at least part of the answer to the question.

6. Make sure your project does not hurt animals or scare people, including yourself. It's not only a bad idea, but it is also against the rules of our science fair.

7. Do not use dangerous materials in your project except in very special situations and after getting permission from the coordinators. Ask advice about this from your parents or organizers.

8. Finally, try to choose a project that, even when you are done with it, it makes you think of new things. One way to tell if you have a good project is to see if the results make you wonder about other things. Did doing the project, or reading about it, or seeing what happened make you think of other questions you are curious about? Now that's a great project!

Steps to Prepare a Science Fair Project

1. **Find a topic -** The topic or subject can be from any of the traditional scientific fields: biology, environment, chemistry, physics, math, architecture, astronomy, engineering, consumer related, and computers. Or it can be some other area as well.

There are many kinds of question you can ask. Keep your eyes open and if you notice something that you do not understand then ask why it happens. You might see something and wonder what causes it. You may want to know how or why something works. Ask questions about what you have observed. For example, what makes the best popcorn, or what is the best battery.

2. **Gather background information**, ***bibliography*** – The best questions are those that have not been asked before. Before doing too much experimentation you should find out as much as possible about the subject. It may be interesting to ask why toast always seems to land buttered side down when it falls off the table, but that question has been well-studied already. Read books, magazines, search the Internet, or ask around. Keep track of where you got your information.
Note: this step is appropriate only for older students (grades 3-8).

3. **Your Hypothesis** – A hypothesis is your guess about what the answer will be. Your project should test your hypothesis: prove or reject - either case is OK. Many times, it is only after the project is built that you realize that your hypothesis, your guess, was wrong.

4. **Build your project:** Here are some examples of projects:
- Observations: How many different types of birds can be found in your backyard? What time of the day do they come? What do they eat? Do they always sit on the same branch?
- Computer program – Use a computer program to simulate traffic jams. How is it possible that there is a traffic jam even though no car is stuck?
- Statistics: What are the most popular activities during recess? Is there a difference in different grades?
- Experiment: What happens to bones without calcium?
- Build a physical model – Build an artificial habitat for animals. See what they like the most. Build a bridge out of marshmallows that will support a dictionary.
- Compare the quality of different brands of popcorn (the one in which the most kernels will pop). What is the correlation between the price of the popcorn and its quality.

The steps:

1. Design - Design a model or experiment to test each hypothesis. Make a step-by-step list of what you will do to answer your questions. This list is called an experimental procedure.

2. Get the materials -- Make a list of the things you need to do the experiments, and prepare them. If you need special equipment, a local college or business may be able to loan it to you. Another source of science materials are mail order supply houses such as Edmund Scientific in Barrington, New Jersey (phone 1-609-457-8880 for a catalog). Search the web.

3. Build it – Make sure you leave enough time to build. Our experience is that it always takes longer to build something than you think it will at first.

Guidelines for Experimental Procedures

- Select only one thing to change in each experiment. Things that can be changed are called variables.
- Change something that will help you test your hypothesis.
- The procedure must tell how you will change this one thing.
- The procedure must explain how you will measure the amount of change.
- Each type of experiment needs a "control" for comparison so that you can see what the change actually did.

5. **Data Collection -** Collect the data (the results). It is easier to understand the data when you write it in tables, graphs or charts. Data can be amounts of chemicals, its length, its time, etc. If you are not making any measurements, you probably are not doing an experimental science project.

Observations can be written descriptions of what you noticed during an experiment, or problems you encountered. Keep careful notes of everything you do, and everything that happens. You should get a special notebook called log book or journal and write down the date you make each observation, what you observe and your thoughts about it.

Using the trends in your experimental data and your experimental observations, try to answer your original questions. Is your hypothesis correct? Now is the time to pull together what happened, and assess the experiment(s) you did.

It is important to keep records of what was done during any science project, and this includes both successes and failures. Each project is expected to have a log book or journal that includes all the data (the measurements or observations) and the date they were taken. Even if your project does not use data, you should still keep records. For example, when did you start to build your model, things you tried that did not work, etc. It is almost always true that we learn more from what doesn't work than from what does work. Don't be afraid to write what did not work as it will not be held against you. In fact, the opposite is true.

6. Conclusions - The conclusion presents the data analysis, explains what happened and the results. Did the data support your hypothesis? What you have learned may allow you to answer other questions. Many questions are related. Several new questions may have occurred to you while doing experiments. You may now be able to understand or verify things that you discovered when gathering information for the project. Questions lead to more questions, which lead to additional hypothesis that can be tested.

What if your experiment or project doesn't work? Don't worry: no matter what happens, you will learn something! Science is not only about getting "the answer." Knowing that something didn't work is actually knowing quite a lot. Experiments that don't turn out as planned are an important step in finding an answer.

Other things you can mention in the conclusion

- If your hypothesis is not correct, what other "guesses" might be the answer to your question?
- Summarize any difficulties or problems you had doing the experiment.
- Do you need to change the procedure and repeat your experiment?
- What would you do differently next time?
- List other things you learned.

7. Poster - Write a poster to present your project. It should include:

〈 The story of your project (why you chose this topic).
〈 What is your question? What is your hypothesis?
〈 How did you choose to answer your question and how did you design the project to do so.
〈 Method and materials - Explain your process and how you planned and built your project/model.
〈 Data collection - Include your original data book.
〈 Results and conclusions - show and explain the results (graphs, charts, or table) and your conclusion(s).
〈 Bibliography - Include your sources of information.

Some tips for a good poster:

- The poster size must be of regulation size as space might be limited at the fair.
- Write only few words, emphasizing only the important points. Long sentences are hard to read on a poster.
- Write with large letters, so people can read it.
- Write with a bright clear marker or print it in a large print (font) size.
- Show the graphs, tables and picture. They use up less space and are easier to understand.

9. **Construct an Exhibit/Display** – Your display should be neat and clear. Make it fun and make sure people can understand what you did. Your display should include:

- Your poster
- Your model
- Anything else you used in your project that is important.

Remember that your display should fit on a standard school desk.

10. **Presentation -** Practice explaining your project to someone (parent, friend, grandparent, etc.) This will help you be calm on Science Fair Day. The judges are very nice and will be quite interested in what you did and what you learned.

11. **Come to the Fair and have fun! See you there!**

Remember that a Science Fair Project is **when you find an answer to a question**, not just showing what you know about something.

Suggested time schedule:

Week 1 - Choose a topic for your question (ask a question)
Week 2 - Gather background (books, internet, ask experts)

Week 3 - Plan the project; get permission to work with animals or humans
Week 4 - Build your project
Week 5 - Run experiments and record the data
Week 6 - Conclusions and analyzing of the data
Week 7 - Write a poster of the project