

The Official Guidebook

for the

2012

Resurrection Saint Paul School

Science Fair



Dear Parents,

Your child has been invited to take part in a science fair, an exciting event that encourages students to think like young scientists. During the next few weeks your child will be designing a science project that uses the scientific method to solve a problem. We hope you agree that the educational benefits are numerous, as students develop skills in writing, oral presentation, creative thinking, and problem solving.

- Each student has been given this set instructions. Most of the work will be completed at home, under your supervision, but we will have *mentoring sessions* on Tuesday, **January 24th and February 7th from 3:45 to 4:30**. To coach the individual child on their progress (you might want to mark your calendar so you don't forget ☺)

The Fair itself will be held **Thursday March 15th at 6:30 PM**. For suggestions on helping your child through this process — from choosing a topic to the final report — see the Web site "Surviving Science Fair" at <http://discoveryschool.com/sciencefaircentral/elmers/>.

Look through this packet, and help your child understand the details. We ask that you encourage your child and monitor his or her progress along the way. Your support is key to a successful project, but please do not "run" your child's project for them – this way we assure equity and promote student learning! It is important that your child wrestle with problems and try to solve them. Guide your child whenever and wherever you can, but let the final project reflect your child's individual effort and design. Also, keep in mind that a successful project can be completed for under \$10.

Please let us know if you'd like more information on creating a successful science fair project. If you have any questions, do not hesitate to contact us (especially by email, as both Mr. Martineau and I are difficult to reach by phone). We look forward to watching your child enjoy this unique opportunity for scientific discovery!

Sincerely,

Thomas A Seitz (Thomas.seitz@NGC.com) ph (410)750-9405

Michael Martineau (Michael.Martineau@ngc.com) ph (410)750-6927

Basic Rules of a the Science Fair

- **Parent/Adult Help** – In some science fairs, it is considered wrong to have your parents or other adults help you. In our science fair, we encourage you to work with your parents to maximize the learning experience and “fun” of discovery! We ask that the adults let the children do the experiments themselves, and come up with their own ideas for experimentation. But especially in the younger grades, the more you work with your child, the more they will get out of the project! Go for it, but be honorable!
- **JUDGING** – attached in the back of this handout is the criteria our judges will use to judge the event. Each entry will be judged by grade level, and given an award for “Excellent, Very Good, or Honorable Mention”

Display Restrictions

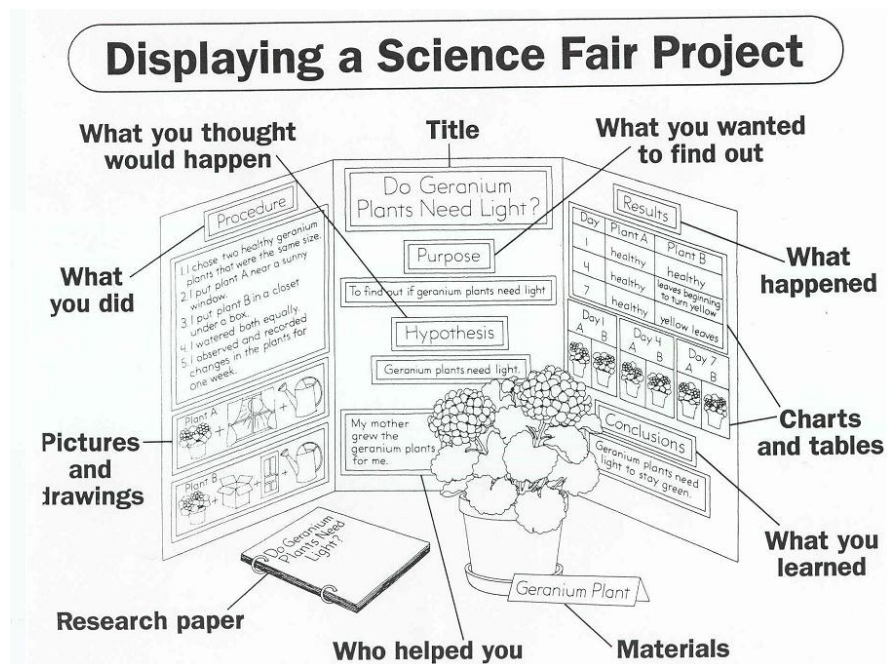
- **Size of Display** — Maximum 48 inches wide, 48 inches high, 30 inches deep.
- **Organisms** — no living creatures, including animals, plants, and microorganisms can be displayed. No type of cultured growth, spoiled food, or molds can be displayed.
- **Tissue** — no human or animal tissues can be displayed. Teeth, hair, nails, dried animal bones, histological sections and mounted slides are allowed.
- **Specimen** — no taxidermy or preserved animals, embryos, can be displayed.
- **Photographs** — no visual presentations of surgical techniques, dissections, etc. or other possibly offensive photos can be displayed. If in doubt, email Tom or Michael.
- **Solid Waste** — no solid waste, soil or other waste material may be displayed.
- **Chemicals** — no chemicals of any kind, including water, can be displayed.
- **Foodstuff** — no human or animal food can be displayed (too many potential bug problems)
- **Sharp items** — no syringes, needles, pipettes or other sharp instruments can be displayed.
- **Controlled Substances** — poisons, drugs, controlled substances, explosives, hazardous devices or weapons cannot be displayed.
- **Dry Ice** — dry ice or other solids that vaporize may not be displayed.
- **Fire** — no open flames or highly combustible materials are allowed. Tanks, full or empty, used for storage of combustible gases or liquids are not to be displayed.
- **Machinery** — no unshielded belts, chains, pulleys or other hazardous moving parts shall be displayed.
- **Lasers** — only class II lasers with proper warning labels displayed are allowed. Class III and IV are not allowed.
- **Heat Source** — materials heated above 100 degree F are not allowed without adequate insulation and pre-approval by Mrs. Murphy and the Event Facilitators.
- **Electric Current** — no unshielded high voltage equipment, large vacuum tubes, ray-generating devices, bare wires and knife switches carrying current at more than 12
- **Embellishments** — awards, medals, business cards personal information and photographs are not allowed.
- **Batteries** — no open cell batteries may be displayed. The kind you buy in the store are just fine as long as you don't cut them or expose the “guts” of the batteries.

The Display



- Project displays tend to be a source of great frustration to students, teachers and parents ... but they don't have to be! What you need to do is **PLAN AHEAD** and then **THINK OF YOUR AUDIENCE**. Remember that they weren't there when you did the experiment, so what seems obvious to you will not be obvious to them unless you make it extremely clear. **Maximum size of the display is 48 inches wide, 48 inches high, 30 inches deep.**

- Ideally, choose a display board that is cardboard and a "tri-fold," meaning that it folds into a middle and two side sections. This shape is the most stable and will stand up in the science fair display. These boards are usually available at stores like Office Depot. I strongly advise against the flimsier posterboard, which tends to fall down easily and irritates teachers and judges. Also avoid wood backboards, which are **VERY** difficult to transport!
- Type up or neatly print the elements described on the first page of this handout. Once you have written or typed up all of the above sections, be sure you have **TITLES** for each section that are large and legible (I'd suggest 24 point or so on the computer). That way if people have questions about some part of your project, they can go right to the section they need to answer their question. Arrange the sections of the report on the board in a way that is attractive and also logical. The purpose and hypothesis should be easy to see right away. An art teacher can give you some good suggestions about how to use paper of different colors to draw attention to parts of the report and make it look terrific!



Additional Information to help
you through the Process.....

Step-By-Step Guide to a Hassle-Free Science Project.....

BACKGROUND OR INTRODUCTION:

- Find a topic that really interests you.
- Get a lab notebook (composition books are good)
- Become knowledgeable about the topic by reading books, surfing the web, and observing as much as you can on your own. Record all notes and references in the beginning of your lab notebook. This list of references provides information for viewers of your project, judges and other students; but much more importantly, it is a scientific ethic to acknowledge carefully what information and ideas you used to develop your ideas.
- Develop a list of questions (the more the better) that have to do with understanding why a certain cause produces an effect. The more you know about a topic, the more refined your list of questions can be. Write all questions in your lab book.
 - From this list, pick a topic that is both interesting and doable.

PROBLEM STATEMENT:

- The Problem Statement tells others what you are trying to find out by doing this project.
- State the problem or questions within the problem into something that can be measured (quantitative) terms.
 - Good Example: (quantitative) Does fertilizer cause radish plants to grow taller?
 - Bad example: (qualitative) Does fertilizer cause radish plants to grow better?

HYPOTHESIS:

- Start your project with a Hypothesis – an educated guess about your problem statement. A valid hypothesis includes the thing that you will study and vary (the independent variable) and the thing you will measure or observe that may change as a result (the dependent variable).
 - Example: The speed of a toy car on a ramp will increase with the amount of weight. (Speed is the dependent variable and weight is the independent variable.)
 - Another Example: The color of certain flowers depends on the pH of the soil.

MATERIALS:

- List all the materials you are using in your lab notebook so that someone else could repeat your experiment.
- Use metric measurements of the quantities whenever possible.

PROCEDURE:

- In numbered outline form in your lab notebook, write down exactly how you do your experiments each day (so that someone else could repeat them.)
- *Tip:* Don't wait until the next day to record your labs— they will not be as accurate.
- Also you must date each entry in your notebook. You will use these notebook entries when you write up your project.
- Replicating your experiment several times makes it more valid.
- Keep all your variables constant except the one you are testing.
- Have a control group so that you can compare your experimental results against an expected known result (your control).

OBSERVATIONS:

- As you conduct an experiment, take notes along the way about what you observed. What did you notice as you did your experiments? (For instance, did you see bubbles or did something change colors?)
- Write down all your observations in your lab notebook as they happen and date them.
- Pictures and photos are also very useful to show observations.

DATA TABLE:

- You should be able to place your observations into an organized table to compare the results. The most common way to show this is with a data table.
- Make a box or boxes with columns and rows clearly labeled and write the numbers from your lab notebook in it. (Your mentor and/or parent can help you with your data table as well as the arithmetic).

GRAPH:

- When comparing different things, it is a good idea to create a visual picture of your data, giving the reader a way of understanding your results easily. A graph is very useful in most experiments.
- The graph is a picture of your data. Some types of graphs that are commonly used are line graphs and bar graphs.
 - A line graph is used to show a gradual change. (The temperatures from June 1-30 in New Haven.)
 - A bar graph is used to compare different things. (The number of oaks, maples and pine trees on a plot of land.)

RESULTS:

- Summarize your data table and graph in a few sentences. What do they show you?

CONCLUSIONS and LIMITATIONS:

- When your experiment is done, you can reflect back on the experiment, and draw some conclusions.
 - Did you get the results you expected? Why or why not?
 - Note: It is not so important that your hypothesis is correct; if your experiment is valid, it is still good science.)
- Think back on your methods. How did you run your experiment, and how would you make it better next time? Did you:
 - have a control?
 - replicate your experiment several times?
 - measure accurately?
 - take careful dated notes in the lab book?

APPLICATION:

Did you clearly state the real world applications and implications for society of your experiment?

Helpful Website Links!

Elmer's Glue Has a Great set of ideas for projects and resources:

<http://school.discoveryeducation.com/sciencefaircentral/scifairstudio/handbook/>

<http://school.discoveryeducation.com/sciencefaircentral/scifairstudio/links.html>

Good project ideas from Simple to complex

<http://www.scifair.org/>

<http://www.loc.gov/rr/scitech/selected-internet/scifair.html>

Other Helpful links:

[Yahooligans](#) - Help with homework, fun things to do - the search engine for kids!

[CyberFair](#) - Our own Virtual Science Fair - how to do a project and examples of good science fair projects.

[Exploratorium Participatory Museum](#) - Interactive art and science exhibits.

[Gallery of Interactive Geometry](#) - Examples and exercises that show the beauty and usefulness of geometry.

[International Arctic Project](#) - Learn more about the top of the world from people who explore it.

[JASON Projects](#) are a set of projects sponsored by NASA and others with the purpose of getting children involved in and excited about scientific exploration.

[Periodic Table of the Elements](#) - Look by atomic number, name or symbol.

[Louvre](#) - one of the most famous art museums in the world. It has beautiful pictures you can view, interesting information about the artists and a tour of Paris.

[University of California, Museum of Paleontology](#) - Interested in dinosaurs and other prehistoric animals or plants? This is THE place!

[NASA](#) - Space shuttle information, Mars exploration and lots more. You can even send them questions on email!

Science Fair Program Guide for RSPS 2012

Elements of A SCIENCE FAIR PROJECT, GRADES 3-8

Scientific Method

A science project is an investigation using the scientific method to discover the answer to a scientific problem. Before starting your project, you need to understand the scientific method. This section uses examples to illustrate and explain the basic steps of the scientific method. The scientific method is the "tool" that scientists use to find the answers to questions. It is the process of thinking through the possible solutions to a problem and testing each possibility to find the best solution. The scientific method involves the following steps: doing research, identifying the problem, stating a hypothesis, conducting project experimentation, and reaching a conclusion.

Research

Research is the process of collecting information from your own experiences, knowledgeable sources, and data from exploratory experiments. Your first research is used to select a project topic. This is called topic research. For example, you observe a black growth on bread slices and wonder how it got there. Because of this experience, you decide to learn more about mold growth. Your topic will be about fungal reproduction. (*Fungal* refers to plant-like organisms called fungi, which cannot make their own food, and *reproduction* is the making of a new offspring.) **CAUTION: If you are allergic to mold, this is not a topic you would investigate. Choose a topic that is safe for you to do.**

After you have selected a topic, you begin what is called project research. This is research to help you understand the topic, express a problem, propose a hypothesis, and design one or more project experiments—experiments designed to test the hypothesis. An example of project research would be to place a fresh loaf of white bread in a bread box and observe the bread over a period of time as an exploratory experiment. The result of this experiment and other research give you the needed information for the next step—identifying the problem.

- **Do** use many references from printed sources—books, journals, magazines, and newspapers—as well as electronic sources—computer software and online services.
- **Do** gather information from professionals—instructors, librarians, and scientists, such as physicians and veterinarians.
- **Do** perform other exploratory experiment related to your topic.

Problem

The problem is the scientific question to be solved. It is best expressed as an "open-ended" question, which is a question that is answered with a statement, not just a yes or a no. For example, "How does light affect the reproduction of bread mold on white bread?"

- **Do** limit your problem. Note that the previous question is about one life process of molds—reproduction; one type of mold—bread mold; one type of bread—white bread; and one factor that affects its growth—light. To find the answer to a question such as "How does light affect molds?" would require that you test different life processes and an extensive variety of molds.
- **Do** choose a problem that can be solved experimentally. For example, the question "What is a mold?" can be answered by finding the definition of the word *mold* in the dictionary. But, "At room temperature, what is the growth rate of bread mold on white bread?" is a question that can be answered by experimentation.

Hypothesis

A hypothesis is an idea about the solution to a problem, based on knowledge and research. While the hypothesis is a single statement, it is the key to a successful project. All of your project research is done with the goal of expressing a problem, proposing an answer to it (the hypothesis), and designing project experimentation. Then all of your project experimenting will be performed to test the hypothesis. The hypothesis should make a claim about how two factors relate. For example, in the following sample hypothesis, the two relating factors are light and bread mold growth. Here is one example of a hypothesis for the earlier problem question:

"I believe that bread mold does not need light for reproduction on white bread. I base my hypothesis on these facts:

1. Organisms with chlorophyll need light to survive. Molds do not have chlorophyll.
 2. In my exploratory experiment, bread mold grew on white bread kept in a dark bread box."
- **Do** state facts from past experiences or observations on which you base your hypothesis.
 - **Do** write down your hypothesis before beginning the project experimentation.
 - **Don't** change your hypothesis even if experimentation does not support it. If time permits, repeat or redesign the experiment to confirm your results.

Project Experimentation

Project experimentation is the process of testing a hypothesis. The things that have an effect on the experiment are called variables. There are three kinds of variables that you need to identify in your experiments: independent, dependent, and controlled.

The **independent variable** is the variable you purposely manipulate (change). The **dependent variable** is the variable that is being observed, which changes in response to the independent variable. The variables that are not changed are called **controlled variables**.

The problem in this section concerns the effect of light on the reproduction of bread mold. The independent variable for the experiment is light and the dependent variable is bread mold reproduction. A control is a test in which the independent variable is kept constant in order to measure changes in the dependent variable. In a control, all variables are identical to the experimental setup—your original setup—except for the independent variable. Factors that are identical in both the experimental setup and the control setup are the controlled variables. For example, prepare the experiment by placing three or four loaves of white bread in cardboard boxes the size of a bread box, one loaf per box. Close the boxes so that they receive no light. If,

at the end of a set time period, the mold grows, you might decide that no light was needed for mold reproduction. But, before making this decision, you must determine experimentally if the mold would grow with light. Thus, control groups must be set up of bread that receives light throughout the testing period. Do this by placing an equal number of loaves in comparable-size boxes, but leave them open.

The other variables for the experimental and control setup, such as the environmental conditions for the room where the boxes are placed—temperature and humidity—and the brand of the breads used must be kept the same. These are controlled variables. Note that when designing the procedure of your project experiment, you must include steps for measuring the results. For example, to measure the amount of mold growth, you might draw 1/2-inch (1-cm) squares on a transparent sheet of plastic. This could be placed over the bread, and the number of squares with mold growth could be counted. Also, as it is best to perform the experiment more than once, it is also good to have more than one control. You might have one control for every experimental setup.

- **Do** have only one independent variable during an experiment.
- **Do** repeat the experiment more than once to verify your results.
- **Do** have a control.
- **Do** have more than one control, with each being identical.
- **Do** organize data. (See [A Sample Project](#) for information on organizing data from experiments.)

Project Conclusion

The project conclusion is a summary of the results of the project experimentation and a statement of how the results relate to the hypothesis. Reasons for experimental results that are contrary to the hypothesis are included. If applicable, the conclusion can end by giving ideas for further testing.

If your results do not support your hypothesis:

- **Don't** change your hypothesis.
- **Don't** leave out experimental results that do not support your hypothesis.
- **Do** give possible reasons for the difference between your hypothesis and the experimental results.
- **Do** give ways that you can experiment further to find a solution.

If your results support your hypothesis:

You might say, for example, "As stated in my hypothesis, I believe that light is not necessary during the germination of bean seeds. My experimentation supports the idea that bean seeds will germinate without light. After seven days, the seeds tested were seen growing in full light and in no light. It is possible that some light reached the 'no light' containers that were placed in a dark closet. If I were to improve on this experiment, I would place the 'no light' containers in a light-proof box and/or wrap them in light-proof material, such as aluminum foil.

Example of a **JUDGES' SHEET EVALUATION**

	POINTS *	SECTION TOTALS
1. Scientific Thought (30 Points)		
1. Purpose of project and hypothesis are clearly stated, identifying independent and dependent variables (cause and effect)	<input type="text"/>	SECTION ONE TOTAL
2. Experimental and control groups are clearly stated and experiment is valid (one independent variable)	<input type="text"/>	
3. Procedure is explained step by step and materials are listed.	<input type="text"/>	
4. Conclusions and limitations are directly related to hypothesis and discuss validity of experiment.	<input type="text"/>	
5. Real world applications and implications for society are clearly stated.	<input type="text"/>	
6. All above points are recorded in lab book as well as on poster.	<input type="text"/>	
2. Thoroughness (15 Points)		
1. Qualitative/quantitative measurements have been made and recorded in lab book.	<input type="text"/>	SECTION TWO TOTAL
2. Experimentation demonstrates at least 3 trials (replications).	<input type="text"/>	
3. Display is neat, well organized and without spelling and grammatical errors.	<input type="text"/>	
3. Skill (10 Points)		
1. Measurements and data are displayed in data table and graph format.	<input type="text"/>	SECTION THREE TOTAL
2. Graph is legible and shows mastery of elements: title, key, labeling of x and y axes.	<input type="text"/>	
4. Research Paper and Lab Notebook (15 Points)		
1. There is a complete, neat and legible lab book with dates, documenting experimental data.	<input type="text"/>	SECTION FOUR TOTAL
2. Scientific method is utilized: statement of problem, statement of hypothesis with variables identified, procedure is described, results, conclusion and discussion of validity in both lab book and research paper.	<input type="text"/>	
3. References and bibliography are properly made in research paper.	<input type="text"/>	
5. Student Oral Presentation (30 Points)		
(Can student explain the science behind the project?)	<input type="text"/>	SECTION FIVE TOTAL
1. Is there evidence that the idea for the project is original and that the project was carried out in an original or inventive way?	<input type="text"/>	
2. Can student explain validity of the experimental method behind the project?	<input type="text"/>	
3. Can the student offer logical solutions to "what if" questions related to his or her project?	<input type="text"/>	
4. Based on the student's explanation does the project represent an appropriate level of difficulty?	<input type="text"/>	
5. Can student explain the conclusions in terms of the relationships between the independent and dependent variables?	<input type="text"/>	
6. Are the real world applications and implications for society of the project clearly stated by student?	<input type="text"/>	
GRAND TOTAL		<input type="text"/>

* Please assign a value from 1 (lowest) to 5 (highest) for each item

Name of Project: _____

Name of Student: _____

Name of Teacher: _____

Display #: _____ Judge Name: _____ Mentor Name: _____