# Science Fair Planning Guide for Oak Hills Elementary 4th, 5th, and 6th Grade Students

## What a Science Fair Project Is NOT (for 4th, 5th and 6th graders):

It's **NOT** a research report or literature review on a topic.
- Example: What is nearsightedness? How do solar panels work?

It's **NOT** a model.
- Example: the exploding volcano or a model of our solar system

It's **NOT** a collection.
- Example: sorting collections from nature such as leaves or seashells

It's **NOT** the reproduction of a known procedure.
- Example: Is it possible to make a homemade stethoscope?

These are all good ideas for a general science display. However, they do not follow the criteria for a proper Science Fair Project (one that is based on the Scientific Method). WARNING: When searching "Science Fair" books or websites, be careful! Not all suggested projects follow the criteria or guidelines for a proper Science Fair Project. When in doubt, ask your teacher or Science Fair Site Coordinator.

## The Scientific Method:

Selecting a **topic** of interest → Asking a **question** → Doing **background research** → Making a **hypothesis** → Collecting **materials** and writing out the steps of the **procedure** → Conducting the **experiment** (at least 3 times) → **Recording the data** in a data log book → **Organizing the data** into tables/graphs/charts → **Summarizing the results** → Stating your **conclusions**

A science project is an investigation using the Scientific Method to discover the answer to a scientific question.

## What a Scientific Method-Based Science Fair Project IS for 4th, 5th and 6th graders:

### 1. TOPIC

Select a **TOPIC** that interests you.
- Example: ANTS -- in my backyard, sometimes in my kitchen or at my picnic!

### 2. A GOOD PLAN

Plan a project that:
- *you can do yourself
- *is not costly or dangerous
- *has something you can measure (such as length, time, weight, number, distance traveled, circumference, speed, temperature, volume, etc.)

## 3. DATA LOG BOOK

Get a bound notebook that you will use as a "diary" during your Science Fair project. This will be your **DATA LOG BOOK.** It should be present on the table in front of your poster in case the Judge asks to see it. You should begin by recording in your data log book any **OBSERVATIONS** you have made that are related to your topic.

- Example of a related observation: When I dropped my half-eaten popsicle near an anthill, the ants were attracted to the popsicle so I think ants are attracted to sugar.

## 4. All great Science Fair projects start with a great question!

Ask a **QUESTION** related to your topic that you can answer with an experiment.

- Example of a "which/what and a verb" question:
  Which type of liquid attracts the most ants: sweet, salty or savory?

### Three Types of Questions for Science Fair Projects

**The "Effect" Question:**

What is the effect of _____ on _____?

| | |
|---|---|
| sunlight | the growth of plants |
| soda pop | a piece of meat |
| oil | the speed at which an item slides down a ramp |
| temperature | the size of a balloon |

**The "How Does/Affect" Question:**

How does _____ affect _____ ?

| | |
|---|---|
| salinity | how often live oysters will open up |
| humidity | the distance traveled by snails |
| temperature | the viscosity (thickness) of a liquid |

**The "Which/What and a *Verb*" Question:**

Which/What _____ *(verb)* _____?

| | | |
|---|---|---|
| detergent | *makes* | the most bubbles |
| amount of salt | *decreases* | the temperature at which water boils |
| paper towel | *is* | the most absorbent |
| foods | *do* | mealworms prefer |

## 5. Background Research

Find background information from different references and sources and **read, read, read** about your topic.

- Examples of information to research: What is already known about ants and their behavior around food sources? What is known about sugar and why insects are attracted to sugar?

## Types of References for Background Research

Encyclopedias/textbooks/books
Magazines - such as Scientific American, National Geographic, Time, Smithsonian, etc.
Newspaper articles
Respected websites on the internet
Interviews with experts (engineers, mechanics, physicians, farmers, dentists, etc.)

•Example: Correspond via phone or email with an entomologist from a local university or a professional exterminator and ask questions about ants and their behaviors around foods.

*You should use **at least THREE different references** for your Science Fair project (and at least one reference should be from a non-internet resource).

*Record in your data log book where and when you found each of your references as well as the information you learned and your thoughts and ideas about your project.

*List your references in your data log book or on your poster (your Science Fair Judge may ask to see your list of references). Here are examples of how to properly list (cite) your references. For more examples, go to http://www.oakhillspta.com/ and click on the Science Fair tab, then click on the PDF entitled "References Cited Format."

## Citing References

**Book:**
Smith, G. 2010. The Insects Around Us. Little and Brown, Inc., Boston, 23-59.
**Magazine:**
Cochran, J.A., Wiles, G. and J. Manack. 2012. Ants and their habits and habitats. Scientific American. Volume 34 (3): 47-55.
**Personal Communications with an Expert (via phone, email, or in person):**
Black, Dr. Charles –Interviewed via phone on December 16, 2015. Prof. of Biology, UCLA, Los Angeles, CA.
**Internet Resource:**
Q & A's about Flies & Ants. Viewed on December 9, 2015. Penn State College of Agricultural Sciences website. http://extension.psu.edu/pests/ipm/schools-childcare/schools/kids/pesky-pest-questions-answers/q-as-about-flies-ants

## 6. Hypothesis

Based on your observations and your background research, it's now time to propose a hypothesis for your Science Fair project. A **HYPOTHESIS** is an educated guess/prediction. It is your "best guess" of what you think will be the answer to your question and what you think will happen when you do your experiment. Your hypothesis should be written down in your data log book BEFORE you do your experiment.

*Your hypothesis should make a claim about how two factors relate.

- Example: liquid food sources and the attraction of ants

*A hypothesis is often written as an **If-Then** statement.

- Example: **If** ants have a choice between liquids containing sugar, salt or chicken broth, **then** more ants will move toward the liquid containing sugar.

## 7. Materials

In your data log book, write a detailed and specific list of **MATERIALS** (items) needed to do this experiment. Use metric measurements if at all possible.

- Example: an active anthill, 4 mini Petri dishes, 10 mL tap water, 10 mL of tap water containing 2 grams of store-bought C&H sugar, 10 mL of tap water containing 2 grams of store-bought Morton's salt, 10 mL homemade chicken broth made with tap water, measuring/graduated cylinder, ruler, timer

*REMEMBER - If you are using human subjects during your experiment (even if you are only asking humans about their opinions), then one of your materials needed for your experiment will be the Human Subject Consent Form. You must fill out and photocopy the Human Subject Consent Form and have it signed by each subject and their parent/guardian. Contact Tonia at tsymensma@gmail.com with any questions. The Human Subject Consent Form can be found at the end of this Science Fair Planning Guide, and can also be found online under the Science Fair tab at: http://www.oakhillspta.com/

## 8. Procedures/Experimentation

**FIRST** - Write out a "step by step" set of directions (your **PROCEDURES**) in your data log book.

- Example: *Step 1.* Make and label four 10mL batches of the following liquids: water, water+sugar, water+salt, and chicken broth. *Step 2.* Measure 2mL of the water, put it into a clean mini Petri dish and place the dish 5 cm away from an active anthill. *Step 3.* Measure 2 mL of the water+sugar liquid, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. *Step 4.* Measure 2mL of the water+salt liquid, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. *Step 5.* Measure 2mL of chicken broth, put it into a clean mini Petri dish and place that dish 5 cm away from the same active anthill. *Step 6.* Wait exactly 3 hours then count the number of ants in each mini Petri dish. *Step 7.* Record the number of ants in each mini Petri dish in a table in your data log book. *Step 8.* Repeat the entire experiment (*Steps 2-7*) two more times, at the same time of day but on different days that are approximately the same temperature. Consider taking photographs of your procedure steps and the results (to display on your poster).

**SECOND** - Identify the **VARIABLES** in your experiment:

*The **Independent Variable** is the one thing you are changing in the experiment. A well-designed experiment has only ONE independent variable.

- Example: the type of liquid food source the ants will have access to

*The **Dependent Variable** is what you are observing/measuring which changes in response to the independent variable.

- Example: the number of ants that move into each mini Petri dish

*The **Controlled Variables** are all the variables in the experiment that you do not change.

- Example: use the same anthill, use the same tap water to make the 4 batches of liquids, use the same 10 milliliter (mL) batches of these 4 liquids for all 3 trials of this experiment, use the same brand/size of mini Petri dishes, perform the experiment 3 times at the same time of day on days with similar weather, give the ants the same amount of time to move (3 hours), place the liquids the same distance of 5 centimeters (cm) from the anthill

**THIRD** - Perform your experiment a minimum of three times (3 trials) to prove your results are consistent.

**FOURTH** - Collect your data by recording everything in your data log book. Don't use "white-out" or pencil/eraser in your data log books - use pen only. Do not scribble over anything in your notebook. If you make an error, simply draw a single line through those words then continue.

## 9. Results/Data Analysis

Organize your data into well-labeled charts, tables, or graphs to display the results on your poster. Explain what happened in your experiment and what the data means.

- Example: The "water only" Petri dish served as a control for this ant experiment. The experiment was performed 3 times, using the same anthill, and data was collected each time. An *average* of 32 ants was found in dishes containing water+sugar, an *average* of 10 ants was found in dishes containing chicken broth, and an *average* of 21 ants was found in dishes containing water+salt. No ants were found in the empty dishes. (Create tables, graphs and/or charts to display this data on your poster.) The data from this project demonstrates that more ants were attracted to the water+sugar liquid compared to the other liquids that were tested. The ants were not attracted to the dish with water only. Sugar is an efficient source of energy for insects, so ants have perhaps evolved to seek out foods containing sugar. There were a significant number of ants attracted to the water+salt liquid in this experiment, suggesting that the presence of dietary sodium chloride may also be beneficial for these ants.

## 10. Conclusions

Your conclusion should be a written summary of the results and what you learned from this experiment. Compare your results with your hypothesis and state whether your hypothesis was supported or not supported by your results. Remember, it's OK if your data does not support your hypothesis! That's part of scientific discovery! Give possible reasons for the difference between your hypothesis and the experimental results. Explain what you would do differently if you repeated the experiment. Explain how your results apply to the real world. Give examples of future directions you could take.

- Example: In conclusion, this experiment demonstrated that these ants are more attracted to sugary liquids than to salty or savory liquids. There may be another ingredient present in the savory liquid (chicken broth) that is repelling many ants. Or, the ants may prefer the sugar water because it contains sucrose which is an efficient source of energy for the insects.

The hypothesis for this project was: **If** ants have a choice between liquids containing sugar, salt or chicken broth, **then** more ants will move toward the liquid containing sugar. The hypothesis was supported by the results from this experiment because an average of 32 ants was attracted to the sugary liquid compared to an average of 21 ants for the salty liquid and an average of 10 ants for the chicken broth. Sodium chloride may be an important part of the ants' diet because a large number of ants were attracted to the salt water. This experiment could be repeated using store-bought ant farms in an enclosed environment rather than the anthill setting to see if the experiment yields similar results. In the future, more experiments could be performed examining the effect of different types of sugars or different concentrations of sugar (or salt) on the attraction of ants.

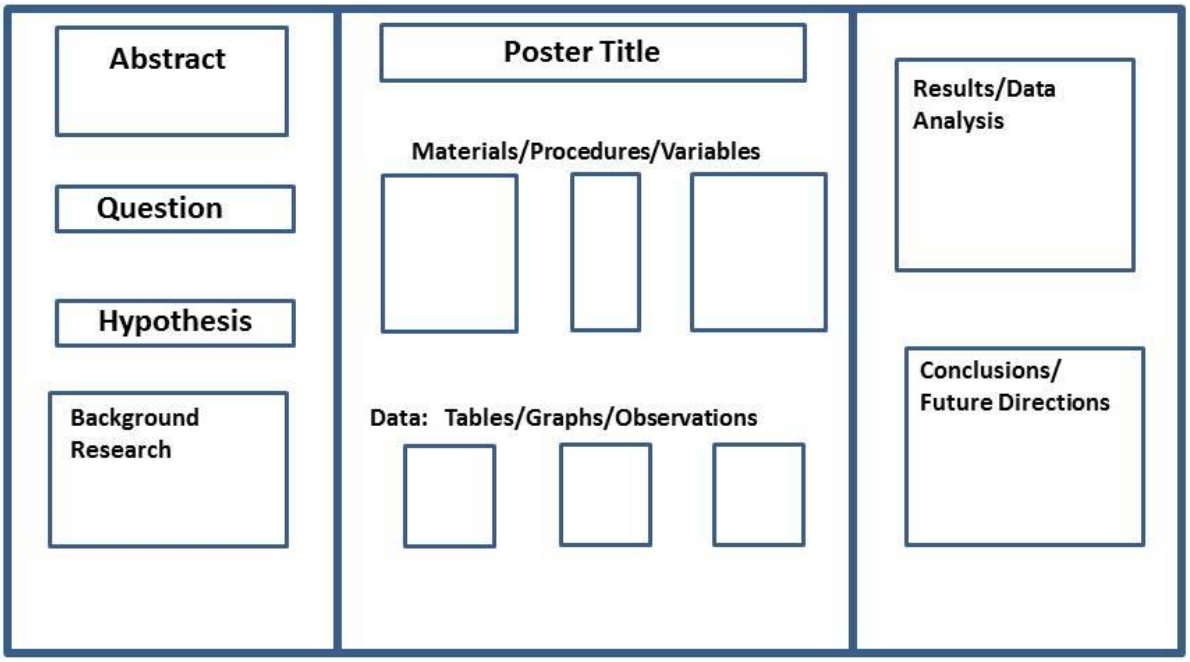
## 11. Abstract

An abstract is a one paragraph summary of your Science Fair project (no more than 250 words). It should be typed, written in the 3rd person and displayed on your poster.

Start with one or two sentences describing the purpose for doing this project and stating the question you are addressing. Describe relevant observations that may have inspired this project. Then, include one sentence stating your hypothesis, one or two sentences that give a general description of your experimental procedure and variables, one sentence describing your more important results, and a final conclusion statement.

## 12. Poster

**Sample of a Science Fair Poster Display – 4th, 5th and 6th graders**




**Posters must be legible and neatly presented on a display board and, due to limited space, can be *no larger than 36 inches tall by 48 inches wide by 18 inches deep*. The poster display board must be able to stand by itself on a table top without support. Your full name, grade level and your teacher's name must be printed on the back of your display board.**

# Advice for the Supervising Adults/Parents of a Student Scientist in 4th, 5th and 6th grade:

**ENCOURAGE** your child's natural curiosity and sense of wonder by sharing in their observations.

**BE A GOOD LISTENER:** What are your child's interests? Help them focus and narrow their questions to ideas that are meaningful to them and testable with the resources available.

**BE POSITIVE**: If you have a positive attitude toward the Science Fair project, your child will hopefully develop that same positive attitude.

**LOOK AROUND FOR IDEAS:** Take your child to the Zoo, Arboretum, Science Center, nature centers, etc.

**SEEK OUT PEOPLE TO HELP YOU:** Contact people you know who have experience in a specific area of science (electricians, doctors, veterinarians, dentists, teachers, farmers, engineers, mechanics, etc.)

**HELP YOUR CHILD KEEP A DAILY LOG OF THEIR RESEARCH ACTIVITIES:** This is called the "data log book" and should be a bound notebook used exclusively for their Science Fair project.

**GO TO THE SCIENCE FAIR FAMILY FUN NIGHT WITH YOUR CHILD**: Have fun and celebrate scientific creativity!

**REMEMBER…IT'S THEIR PROJECT.** Please help and encourage your child to do the best job that they can do, but don't do it for them. This is a chance for the child (not the parent) to showcase their work.