

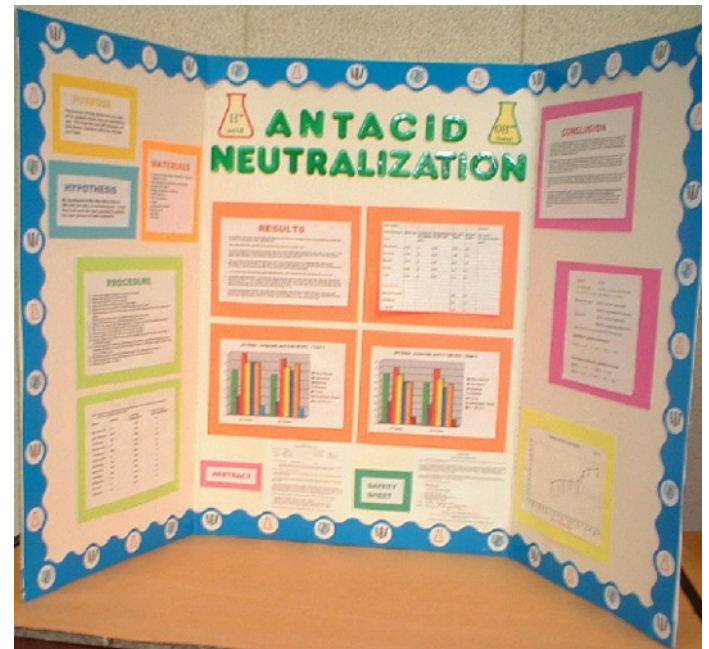
The Science Fair

Getting Started

How do I go from this?



to



that?

Science Fair Notebook

1. Overview & Timeline
2. Topic Brainstorm
3. Question
4. Background Research
5. Hypothesis
6. Materials and Procedures
7. Data Chart
8. Observations
9. Graphs
10. Conclusion

You will do these sections in class.



You will do these sections at home.



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Starting Out

1. Make observations. Think about what interests you.
2. Choose a topic.
3. Write a question.



Remember, your classmates are a great resource. Bounce ideas off of each other.

Choosing a Topic – Start with Some Observations



[Science Fair: Choosing a Topic](#)

Choosing a Topic – What interests you?

1. Check out the science magazines, books, and interesting objects at your table.
2. Take the interest inventory.
3. Record topics that you are interested in in your science fair notebook.
4. Free Write: For 4 minutes write about a topic, question, or project that you might want to work on.

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Types of Science Projects

A Model, Display or Collection



- You display information = A LITTLE BIT BORING!

An Experiment



- You test and collect data = MUCH BETTER!

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Experiments = Testable Questions

- Questions that can be answered by collecting data or making observations.
- Often start with *how*, *what*, or *which*.
- Testable questions are about changing one thing to see the effect on another thing.

Testable Questions

- How does fertilizer affect the growth of bean plants?
- Which type of food will meal worms choose most often?

Not Testable Questions

- What is an electromagnet?
- Why do volcanoes erupt?

Testable Questions

Testable questions always have 2 parts:

- An independent variable
- A dependent variable



What is an Independent Variable?

- The variable that will be changed by you – the scientist.

A good experiment has only one
independent variable!

What is a Dependent Variable?

- The variable that is being measured in your experiment
- It is the response to the change you make using the independent variable.
- Most experiments will have one dependent variable, but you can have more than one.

Change a Question into a Testable Question

First, read the question carefully.

What makes plants grow best?



Change a Question into a Testable Question

Next, think of a **cause** and an **effect** related to your question.

What makes plants grow best?

In this case, the idea is that you can change something to affect something about how a plant grows.



What are examples of things that you can change?

What makes plants grow best?



What are examples of things that you can change?

What makes plants grow best?

Examples:

- Amount of water
- Amount of light
- Soil type
- Fertilizer



What specific effects can you look for?

What makes plants grow best?



What specific effects can you look for?

What makes plants grow best?

Examples:

- Height of plant
- Speed of growth



Finally, plug the cause and the effect into the format...

“What is the effect of _____ on _____?”

The cause goes in the first blank, and the effect goes in the second blank.

So a testable question looks like this:

“What is the effect of fertilizer on plant height?”



Question Sort

1. Sort the questions in your envelope into testable and not testable questions.
2. For the testable questions, be ready to share the independent and dependent variables.

Question Sort Key

TESTABLE

How does humidity affect the growth of fungi?

How does the color of a material affect the absorption of heat?

What is the effect of color on remembering what you have read?

Which material, salt or baking soda, is better at preserving an apple?

How does temperature affect the number of chirps a cricket makes in 30 minutes?

NOT TESTABLE

What happens when I put mentos in coke?

Why do caterpillars spin cocoons?

What are the three types of rocks?

How can you make your own thermometer?

What do you need to build a hovercraft?

Question Sort – Independent Variables

TESTABLE

How does **humidity** affect the growth of fungi?

How does the **color of a material** affect the absorption of heat?

What is the effect of **color** on remembering what you have read?

Which material, **salt or baking soda**, is better at preserving an apple?

How does **temperature** affect the number of chirps a cricket makes in 30 minutes?

Question Sort - Dependent Variables

TESTABLE

How does humidity affect the **growth of fungi**?

How does the color of a material affect the **absorption of heat**?

What is the effect of color on **remembering what you have read**?

Which material, salt or baking soda, is better at **preserving an apple**?

How does temperature affect the **number of chirps a cricket makes** in 30 minutes?

Been There, Done That Questions

- What is the effect of music on plants?
- How do different liquids affect plant growth?
- Which paper towel absorbs the most water?
- How does the temperature of a tennis ball affect its bounce?
- Which brand of battery lasts the longest?
- Which brand of laundry detergent is best at removing stains?
- What is the effect of soda on tooth decay?
- Which brand of popcorn pops the most kernels?
- What cleans pennies the best?
- Coke and Mentos reaction. (This is not an experiment!)

P.S. Because of safety reasons, you also cannot grow bacteria or mold at your house! If you want to do something with bacteria or mold you will need a scientific lab to use.

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Write a Testable Question

- How does _____ affect _____?
- What is the effect of _____ on _____?
- Which/What _____ (verb) _____?



Question Share

Take a white board and write down your topic and/or question.

Visit with your partner. Share your ideas. If your partner has ideas or questions write those down on your whiteboard.

Return to your seat. In your science fair notebook record ideas that came up when you were talking with your partner on your question page.

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Research to Hypothesis

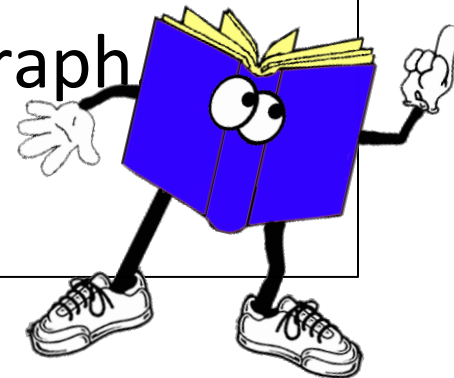
1. Do background research on your topic. Become the expert!

[When you understand the science behind your project it really makes your project stand out!]

2. Revise your question.

3. Write a background information paragraph

4. Write a hypothesis.



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Background Research

- Become the expert on your topic!
- Think of three questions about your topic.
- Research answers to those questions. Write down your source. Where did your information come from?
- EXAMPLE: What do plants need to grow? Why do plants need fertilizer? What is in fertilizer?

Background Information Paragraph

Use the information you learned to write a paragraph about your science topic. In your paragraph explain the science behind your science fair project.

Example:

Plants need sunlight, water, and carbon dioxide in order to produce their own food through the process of photosynthesis. In addition to these key materials, plants also need several nutrients in order to construct new cells and grow. Some of the nutrients that plants need are nitrogen, phosphorus, potassium, calcium, and magnesium. Most plants get these nutrients from the soil. To increase the nutrients in soil, people often add fertilizers. Most fertilizers include nitrogen, phosphorus, and potassium because these key elements are necessary to build parts of new cells.



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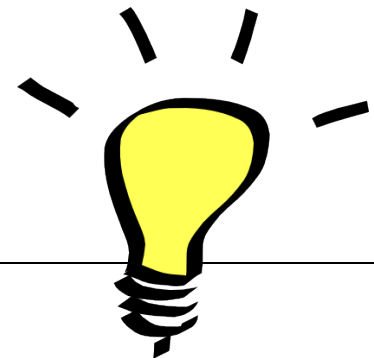
Hypothesis

- The hypothesis is a statement of what the scientist expects to happen in the experiment.
- It is NOT a guess. A hypothesis is based on experience and background research.
- EXAMPLE: If bean plants are given different amounts of fertilizer, then the plants that receive the most fertilizer each week (10 mL) will grow faster because they get more nitrogen when they have fertilizer. Plants need nitrogen in order to grow new stems and leaves.
- TRY IT: If _____, then _____
because _____.

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Planning and Experimenting

1. Reread your question and think about your variables. What are you going to change? What will you measure?
2. Think about what you will keep the same in order to have a fair experiment.
3. Make a plan: materials and procedures.
4. Conduct your experiment.
5. Collect data!





Variable Review

- In a controlled experiment the scientist only changes one factor. This is the **independent variable**.
- All of the other variables are **controlled**. This means these variables stay the same.
- What you measure or observe in the end is your **dependent variable**.
- WHILE YOU PLAN ASK YOURSELF: Does this plan make a fair experiment?

Flowers Around the House

Mr. Jones noticed that his favorite flowers were dying on one side of his house, but on the other side the flowers were alive and beautiful. He thought that the flowers were dying because they were not getting enough sunlight. Mr. Jones decided to do an experiment. He planted 4 flowers in separate flowerpots. He placed 2 of the flowerpots in full sunlight. He placed 2 of the flowerpots in the shade. He watered all of the plants three times per week. He observed the plants everyday for 2 weeks. The plants in the sun made beautiful flowers. The plants in the shade died after two weeks.

Discuss with your table:

What is the independent variable?

What is the dependent variable?

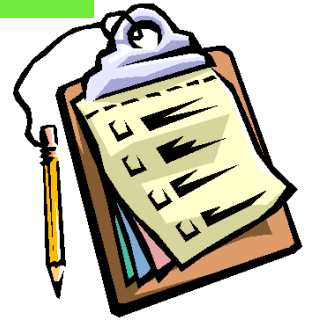
What did Mr. Jones control?



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Materials & Procedures

- All of the materials and quantities should be listed.
- The procedures should be clear enough that another scientist could follow the same method.
- When someone reads your procedures they should be able to figure out what you controlled in your experiment.
- In your plan, write procedures as a paragraph or as steps (1. 2. 3.)



How Could These Procedures Be Better?

My question is:

How does the amount of fertilizer affect the height of bean plants?

Procedures:

1. Plant lima bean seeds in three cups.
2. Put different amounts of fertilizer in each cup.
3. Wait.
4. Record data.

Better Procedures

Procedures:

1. Add 100 mL of soil to 9 cups.
2. In each cup plant 1 lima bean seed by planting it 2 cm below the surface of the soil.
3. Label 3 cups 0 mL, label 3 cups 5 mL, and label 3 cups 10 mL.
4. Add 5 mL of liquid fertilizer to the cups labeled with 5 mL
5. Add 10 mL of liquid fertilizer to the cups labeled with 10 mL.
6. Place all nine cups in the same windowsill that receives 6 hours of sunlight per day.
7. Water each cup with 20 mL of water every 3 days.
8. Every 3 days record the height of the plants and make observations about the color and shape of the leaves.

Now You Try It!

Write a Materials List and Procedures

1. Materials should include quantities.
2. Procedures need to be detailed.
3. When you have made your plan, fill out the **Science Fair Approval** form and hand it in to your teacher.



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Collect Data and Observations

- The data chart is a place to record your observations or measurements.
- Design a chart that includes what you will change (independent variable) and what you will measure (dependent variable).

	Average height of plants with 0 mL of fertilizer	Average height of plants with 5 mL of fertilizer	Average height of plants with 10 mL of fertilizer
Day 3			
Day 6			
Day 9			

- Be sure to record observations you make as well.

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Results and Sharing

1. Create a graph of your data.
2. Write a conclusion.
3. Make your science fair board.

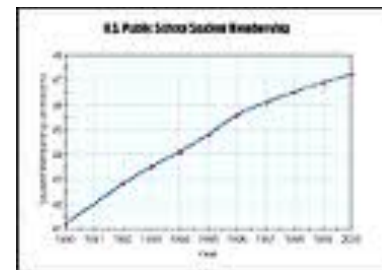
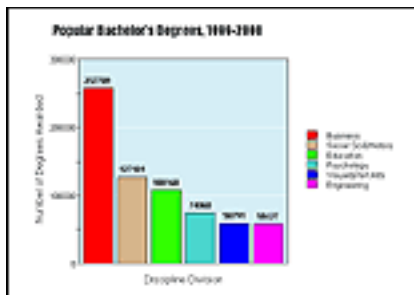
[Science Fair: Examine Your Results](#)



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Graph Your Data

- Using the data you collected create a graph.
- Whether you make a bar graph or a line graph will depend on the data that you collected.





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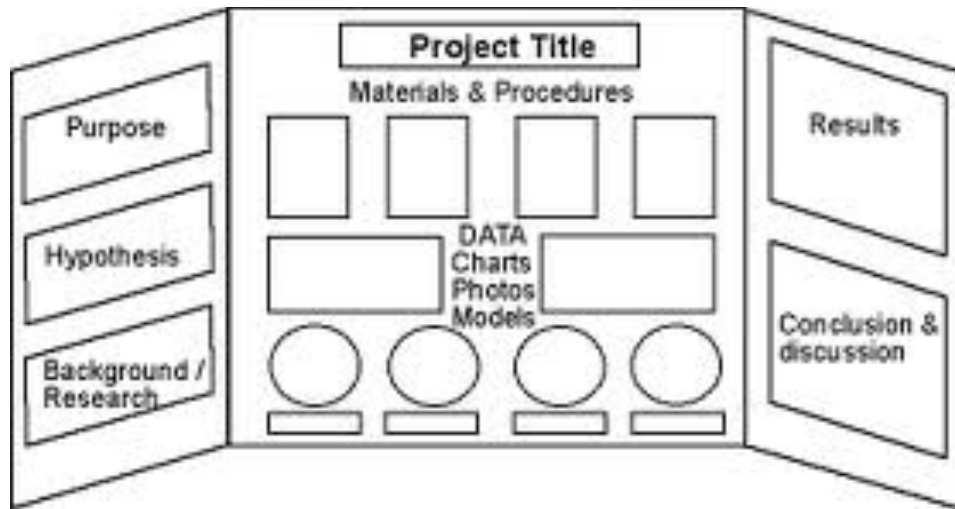
Write Your Conclusion

- State whether your hypothesis was correct or incorrect.
- State your results. What did you find out?
- Include data in your conclusion that supports what you learned.
- **IMPORTANT:** Infer (explain) why your experiment turned out like it did.
Note: You might have to do some more research to figure out what is going on!
- Why is this important?

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Make Your Display Board

- Make a mouth watering display. You have done a lot of work. Make it show!



Hint: Mount white paper, pictures, charts, and graphs, on colored construction paper.