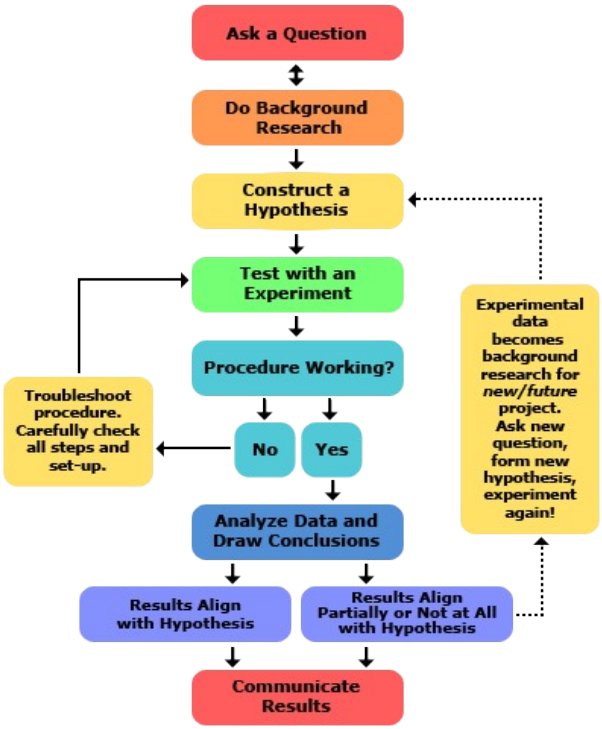
Steps of the Scientific Method

What is the Scientific Method?

The scientific method is a process for experimentation that is used to explore observations and answer questions. Does this mean all scientists follow *exactly* this process? No. Some areas of science can be more easily tested than others. For example, scientists studying how stars change as they age or how dinosaurs digested their food cannot fast-forward a star's life by a million years or run medical exams on feeding dinosaurs to test their hypotheses. When direct experimentation is not possible, scientists modify the scientific method. In fact, there are probably as many versions of the scientific method as there are scientists! But even when modified, the goal remains the same: to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be combined in to a logical answer.

Even though we show the scientific method as a series of steps, keep in mind that new information or thinking might cause a scientist to back up and repeat steps at any point during the process. A process like the scientific method that involves such backing up and repeating is called an iterative process.

Whether you are doing a science fair project, a classroom science activity, independent research, or any other hands-on science inquiry understanding the steps of the scientific method will help you focus your scientific question and work through your observations and data to answer the question as well as possible.



Steps of the Scientific Method	Detailed Help for Each Step
Ask a Question: The scientific method starts when you ask a question about something that you observe: How, What, When, Who, Which, Why, or Where? For a science fair project some teachers require that the question be something you can measure, preferably with a number.	Your Question (http://www.sciencebuddies.org/science-fair-projects/science-fair/science-fair-project-question)
	Background Research Plan (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-science-fair-project-research-plan) Finding Information

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Do Background Research: Rather than starting from scratch in putting together a plan for answering your question, you want to be a savvy scientist using library and Internet research to help you find the best way to do things and insure that you don't repeat mistakes from the past.	(http://www.sciencebuddies.org/science-fair-projects/science-fair/finding-information-for-your-research-paper) Bibliography (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-bibliography-examples-of-apa-mla-styles) Research Paper (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-research-paper-for-your-science-fair-project)
Construct a Hypothesis: A hypothesis is an educated guess about how things work. It is an attempt to answer your question with an explanation that can be tested. A good hypothesis allows you to then make a prediction: "If _____*[I do this]* _____, then _____*[this]*_____ will happen." State both your hypothesis and the resulting prediction you will be testing. Predictions must be easy to measure.	Variables (http://www.sciencebuddies.org/science-fair-projects/science-fair/variables) Variables for Beginners (http://www.sciencebuddies.org/science-fair-projects/science-fair/doing-a-fair-test-variables-for-beginners) Hypothesis (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-a-hypothesis)
Test Your Hypothesis by Doing an Experiment: Your experiment tests whether your prediction is accurate and thus your hypothesis is supported or not. It is important for your experiment to be a fair test. You conduct a fair test by making sure that you change only one factor at a time while keeping all other conditions the same. You should also repeat your experiments several times to make sure that the first results weren't just an accident.	Experimental Procedure (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-experimental-procedures) Materials List (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-materials-list) Conducting an Experiment (http://www.sciencebuddies.org/science-fair-projects/science-fair/conducting-an-experiment)
Analyze Your Data and Draw a Conclusion: Once your experiment is complete, you collect your measurements and analyze them to see if they support your hypothesis or not. Scientists often find that their predictions were not accurate and their hypothesis was not supported, and in such cases they will communicate the results of their experiment and then go back and construct a new hypothesis and prediction based on the information they learned during their experiment. This starts much of the process of the scientific method over again. Even if they find that their hypothesis was supported, they may want to test it again in a new way.	Data Analysis & Graphs (http://www.sciencebuddies.org/science-fair-projects/science-fair/data-analysis-graphs) Conclusions (http://www.sciencebuddies.org/science-fair-projects/science-fair/writing-conclusions)
Communicate Your Results: To complete your science fair project you will communicate your results to others in a final report and/or a display board. Professional scientists do almost exactly the same thing by publishing their final report in a scientific journal or by presenting their results on a poster or during a talk at a scientific meeting. In a science fair, judges are interested in your findings regardless of whether or not they support your original hypothesis.	Final Report (http://www.sciencebuddies.org/science-fair-projects/science-fair/science-fair-project-final-report) Abstract (http://www.sciencebuddies.org/science-fair-projects/science-fair/how-to-write-a-science-fair-project-abstract) Display Board (http://www.sciencebuddies.org/science-fair-projects/science-fair/science-fair-project-display-boards) Science Fair Judging (http://www.sciencebuddies.org/science-fair-projects/science-fair/judging-tips-to-prepare-science-fair)

Throughout the process of doing your science fair project, you should keep a journal containing all of your important ideas and information. This journal is called a laboratory notebook. See the Science Buddies resource Science and Engineering Project Laboratory Notebooks (http://www.sciencebuddies.org/science-fair-projects/science-fair/laboratory-notebooks-stem) for more information.

Educator Tools for Teaching the Scientific Method

Need a hands-on activity to familiarize students with the scientific method? Try our scientific method lesson plans:

- Teaching the Scientific Method with Paper Rockets (http://www.sciencebuddies.org/teacher-resources/lesson-plans/teach-scientific-method) for elementary school
- Learning the Scientific Method with Paper Rockets (http://www.sciencebuddies.org/teacher-resources/lesson-plans/scientific-method-rockets) for middle school

Teachers who are Google Classroom users can assign a beginner student quiz (http://www.sciencebuddies.org/science-fair-projects/project_scientific_method/quiz-002) or an intermediate student quiz (http://www.sciencebuddies.org/science-fair-projects/project_scientific_method/quiz-001) to test student understanding of the scientific method. The quizes can be used as a pre or post evaluation — or even both! Additional quizzes and assignable science fair project submission forms are available on our Google Classroom Integration (http://www.sciencebuddies.org/classroom#scientificmethod) page.
