

Starting a good SEF Project: Picking Your Topic Researching your Project Resources Available

Dr. John Sohl
Department of Physics
Weber State University

45 minutes, conducting journal Research

This notes version of the presentation given in the Ritchey SEF workshop is provided to fill in some of the back story of the presentation and to assist in remembering the important points. It is also a way of passing along the links, which should be live in the notes section of this document.

Selecting a Topic



- Must be REALLY interesting to you
 - Award winning projects involve hundreds of hours
- Must be something reasonable for your skills
- Must be something for which you have the equipment and/or resources. (Mentors)
- Don't be too specific/narrow at first
 - Be flexible, assume that your idea will evolve
 - Expect the project will change
 - Follow interesting new ideas

Realize that award winning projects will involve hundreds of hours of reading, thinking, researching, experimenting (or engineering/programming), analyzing, and preparing your poster.

As you learn more about the topic it is common that your project will change, this is good. Don't get locked into any one idea too doggedly.

I have never started a significant project that ended exactly the way I thought it would.

There are many good resources available for reading articles in different areas of science. Many of these online resources are listed in one of the handouts at the Ritchey SEF fall workshop. Your school, county, or local university/college library will also have good resources to helping you decide on an area of research.

<https://www.sciencebuddies.org> is an excellent place for 6th grade students to begin.

They have a topic wizard that will ask you questions about things you are interested in already and then suggest experiments based on your answers. While these experiments and projects will not be award winning...it is a place to start with an idea that will turn into a fun project. If your project is not fun and holds your interest, then you should look for another project.

Starting Off Right!

- You have an idea or some field that interests you; now what?
- Get informed
 - Find out what has been done by others.
 - Read summary articles: Science News, ScienceDaily, newspapers, Wikipedia, textbooks, etc.
- Narrow your topic
 - Skim professional research journals.
- Get some guidance
 - Look for an adult mentor



The whole point to science is to disseminate and increase knowledge. We simply expect each other to be informed.

You should plan to spend a fair amount of time reading.

<http://www.sciencenews.org/> Science News, a good online resource for current science research for senior fair projects.

<https://www.sciencedaily.com> Your source for the latest research news

https://en.wikipedia.org/wiki/Main_Page

Advisors or Mentors



- More on mentors later today.
- Fact: There are people who know more than you do.
- Ask for suggestions on project topics.
- Ask them for suggestions on where to look for more information.

Start Your Notebook Now

- It *is* a notebook! Put all your notes in it.
- Start each page with a date and brief title of what you are doing:

**Oct. 12, 2019. Looking for papers on
ozone measurements.**

- Judges do look at your notebook. It should be professional and readable, but “*alive*” with scratch-outs and side notes.
- Notes, ideas, sketches, data, code ideas, etc. all go in the notebook.

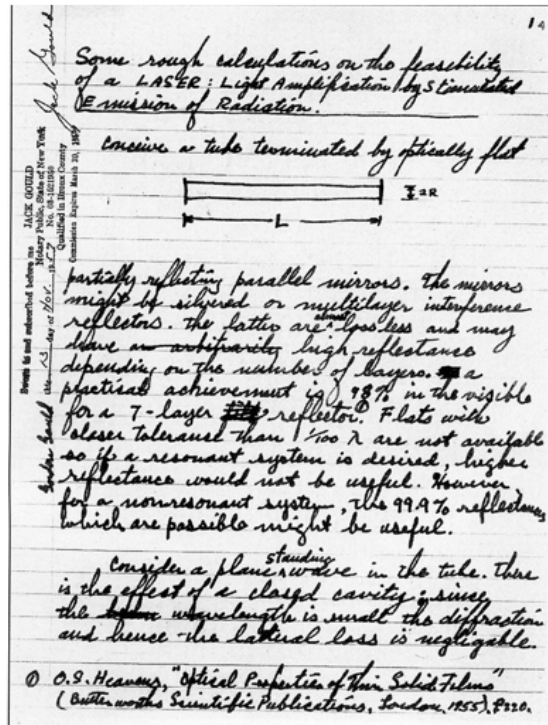
The notebook gives a judge a real sense of how much effort has gone into the project. I’ve seen fancy projects that looked great but only had three pages with anything reasonable in the notebook. It made me suspect, at best, of the entire project.

There is a good handout in your folder (and thumb drive) on notebooks, including how to use an electronic notebook. The difficulty with an electronic notebook is how to show it off to your judges, especially if you are not standing near your project with your electronic device.

The Notebook

- Make notes about everything.
- Write down a reference and note about every article you read.
- All observations are potentially valuable.

Gordon Gould's notebook where the word "laser" is first defined.



One of the failings that many students make is when they are doing their research, they don't write down all the references that they are using to gather background information. Then later when they find out that they need to show these references, they don't remember where they saw them or how to find them again. Also, you need to write down everything in your notebook. All observations are pertinent, there may be a time when something that you have observed will become a key point in explaining your results.

Gordon Gould's notebook image:


https://upload.wikimedia.org/wikipedia/en/d/dd/Gould_notebook_001.jpg

This is the first page of Gordon Gould's famous notebook

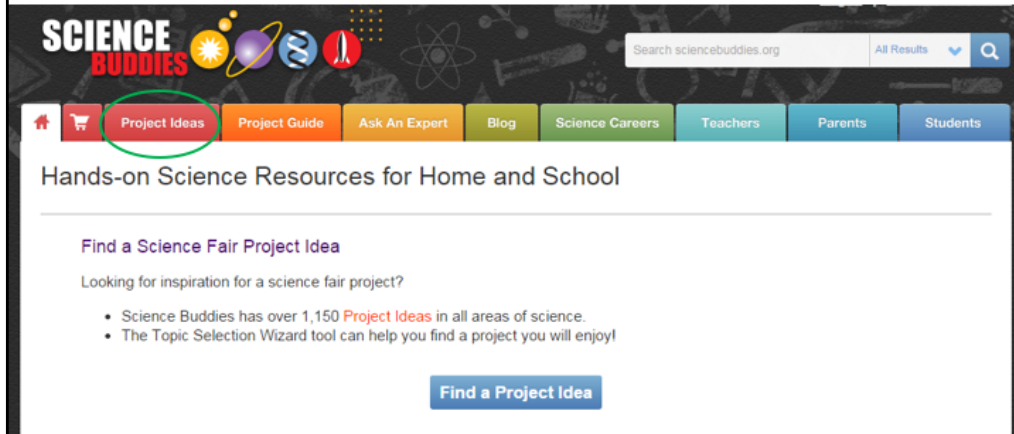
(https://en.wikipedia.org/wiki/Gordon_Gould#/media/File:Gould_notebook_001.jpg)

, in which he coined the acronym *LASER*, and described the essential elements for constructing one. This notebook was the focus of a thirty-year court battle for the patent rights to the laser. Notable is the notary's stamp in the upper left corner of the page, dated November 13, 1957. This date-stamp established Gould's priority as the first to conceive many of the technologies described in the book.

Getting Ideas and Getting Started



- Science Buddies: <https://www.sciencebuddies.org>

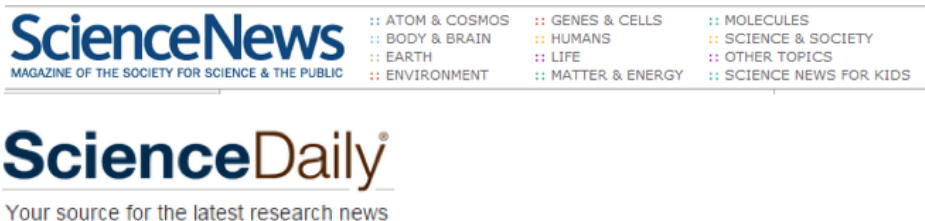


Science Buddies: <https://www.sciencebuddies.org>

This resource, along with many others, is included on one of the handouts in your workshop folder.

Getting Informed, Refining Ideas

- The Internet is wild and wooly
 - Internet wackos and bizarre theories abound!
 - Generally trustworthy are: .edu, .gov, major companies, Wikipedia, professional journals
- Science News = excellent starting point
<https://www.sciencenews.org>
- ScienceDaily = <https://www.sciencedaily.com>



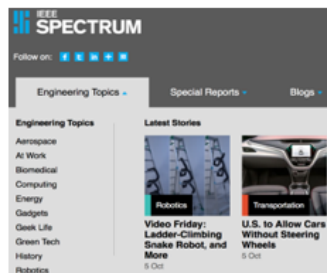
Science News = excellent starting point <https://www.sciencenews.org>

ScienceDaily = <https://www.sciencedaily.com>

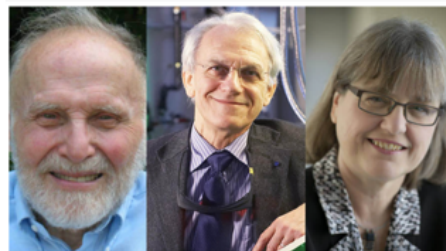
These resources, along with many others, are included in the handouts in your workshop folder.

Getting Informed, Refining Ideas

- Industry & Professional Magazines – news highlights
- Professional Societies – web sites



PHYSICS TODAY



**Ashkin, Mourou, and Strickland share
2018 Nobel Prize in Physics**

Do a net search for the field you are interested in along with a keyword such as “society” or “association” or “institute” and see what comes up. For example, a search with the terms “physics society” will quickly produce the world’s most prestigious professional physics group: The American Physical Society, <https://www.aps.org>. <https://pubs.geoscienceworld.org/>

Introductory Level Journals

(Must use a library or subscribe for full access.)

- Scientific American
 - <https://www.scientificamerican.com>
- **Scientific American – Citizen Science**
 - <https://www.scientificamerican.com/citizen-science/>
- Popular Science <https://www.popsci.com>
- Astronomy Magazine, Sky & Telescope



Citizen Science 

Energy & Sustainability Evolution Health Mind & Brain Space Technology More Science

Almost all public, school, and university libraries have these journals.

Warning: Popular Science and Mechanics tend to be very optimistic.

Scientific American <https://www.scientificamerican.com>

Scientific American – Citizen Science

<https://www.scientificamerican.com/citizen-science/>

Popular Science <https://www.popsci.com>



You Now Have a Project

- Refine and narrow your journal searches.
- Ask your advisor for papers or search terms that would be helpful to know.
- Use your notebook! Make notes about:
 - Ideas & key points you want to remember (be brief, make page references)
 - Questions for your mentor
- Have your questions organized and ready for your next visit with your advisor.

Your mentor is a very busy person. Use their time wisely. Always be prepared when you arrive. Having a detailed list of questions each time is a good first step. It is much better than hoping you'll remember everything you wanted to ask.

While Working on Your Project...

- Questions will come up as you work on your project.
- Try to figure it out yourself at first
 - Try all the same research sources as above.
 - Try searching in Google Scholar.
 - Ask for help if you don't 'get it' after a few hours.
- Be as knowledgeable as possible when you ask your mentor for help with the problem.
- It will pay off! The judges can tell if you know the field or not.

I've had dozens of people tell me that there is no information available in some area or that something is brand new and has never been done before. Then, I spend 30 seconds on the Internet and get a quarter million hits going back for half a century! The only possible conclusion that can be made is that the person is clueless about the field for which they claim to have a passion. It completely changes my attitude towards the person. (And not in a good way!)

How to Find a Journal Article

- Google Scholar: <https://scholar.google.com>
- Wikipedia references
- Textbook references
- Browse School and University Libraries
- JSTOR <https://www.jstor.org>
- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed/>
- Patent Search
<https://patents.google.com>

Google Scholar



Google
Patents

Looking on the shelves in a university library in the journals section will produce all sorts of interesting information and ideas. Ask a librarian for assistance in finding the right areas of the current journals section in which to look.

From the JSTOR website <https://www.jstor.org>: Used by millions for research, teaching, and learning. With more than a thousand academic journals and over 1 million images, letters, and other primary sources, JSTOR is one of the world's most trusted sources for academic content.

Google Scholar: <https://scholar.google.com>

PubMed <https://www.ncbi.nlm.nih.gov/pubmed/>

Patent Search <https://patents.google.com>

Ask a Librarian

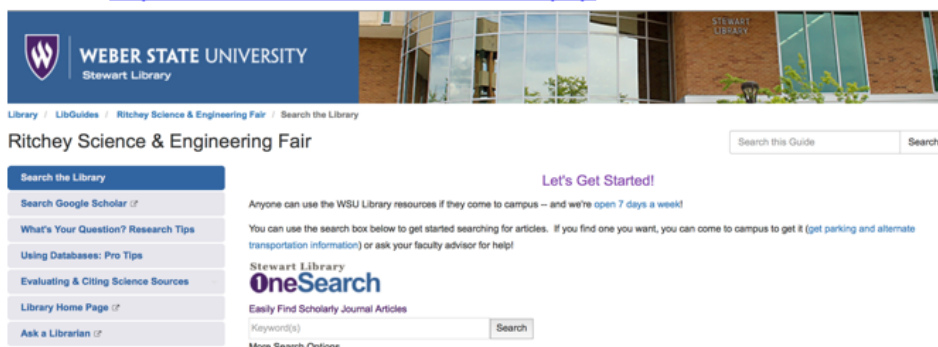
- Librarians are about the most helpful people on the planet.

- <https://library.weber.edu>
- <https://libguides.weber.edu/ritchev>
- <https://library.usu.edu>
- <https://www.utah.edu/libraries/index.php>



WEBER STATE UNIVERSITY
Stewart Library

UtahStateUniversity
UNIVERSITY LIBRARIES

The screenshot shows the Weber State University Stewart Library website. It features a navigation bar with links to Library, LibGuides, and Ritchey Science & Engineering Fair. Below the navigation bar is a search bar and a section titled "Ritchey Science & Engineering Fair". On the left, there is a sidebar with links to "Search the Library", "Search Google Scholar", "What's Your Question? Research Tips", "Using Databases: Pro Tips", "Evaluating & Citing Science Sources", "Library Home Page", and "Ask a Librarian". The main content area includes a "Let's Get Started!" section with text about library resources and a "Stewart Library OneSearch" section with a search bar and a "Search" button.

I think librarians have been genetically altered to be helpful. 😊

<https://library.weber.edu>

The helpful folks at the Stewart Library have put together a special page for science fair students: <https://libguides.weber.edu/ritchev>

<https://library.usu.edu>

<https://www.utah.edu/libraries/index.php>

<https://onlinelibrary.uen.org/login>

Actually Getting the Article

- Getting it can be hard.
 - University libraries, interlibrary loans
 - Ask the author
- Websites for university research groups
 - Go to the author's research group website.
- Google Scholar
- Ask us, we can help.



Ask your school library if they can do interlibrary loans.

At university libraries you have to go there in person if you are not a member of the university.

Sample Google Scholar Search

Google Scholar

atmospheric ozone measurement

Articles Case law

Google Scholar

atmospheric ozone measurement

Articles

About 898,000 results (0.10 sec)

Any time

Since 2018

Since 2017

Since 2014

Custom range...

Sort by relevance

Sort by date

☒ include patents

☒ include citations

☒ Create alert

Implications of recent total **atmospheric ozone measurements** for biologically active ultraviolet radiation reaching the Earth's surface

S Madrosch - Geophysical Research Letters, 1992 - Wiley Online Library

Recent satellite **measurements** of total **atmospheric ozone** were analyzed to deduce the changes in biologically active ultraviolet (UV) radiation reaching the Earth's surface from 1979 to 1989. The calculated increases are on average substantially larger than earlier ...

☆ 00 Cited by 317 Related articles All 9 versions 00

The influence of nitrogen oxides on the **atmospheric ozone** content

PJ Crutzen - Quarterly Journal of the Royal Meteorological ..., 1970 - Wiley Online Library

... Belgian urban areas based on airborne APEX remote sensing, **Atmospheric Measurement**

Techniques, 10 ... **Ozone** Hole, (37) Crossref. S. Gebauer, JL Grenfell, JW Stock, R. Lehmann ...

Biospheres of Early Earth Analog Planets with a Coupled **Atmosphere** Biogeochemical Model ...

☆ 00 Cited by 1661 Related articles All 9 versions 00

Google Scholar

Advanced search

Find articles

with all of the words

with the **exact phrase**

with at least one of the words

without the words

where my words occur

☒ anywhere in the article

☐ in the title of the article

Return articles authored by

e.g., "PJ Hayes" or McCarthy

Return articles published in

e.g., J Biol Chem or Nature

Return articles dated between

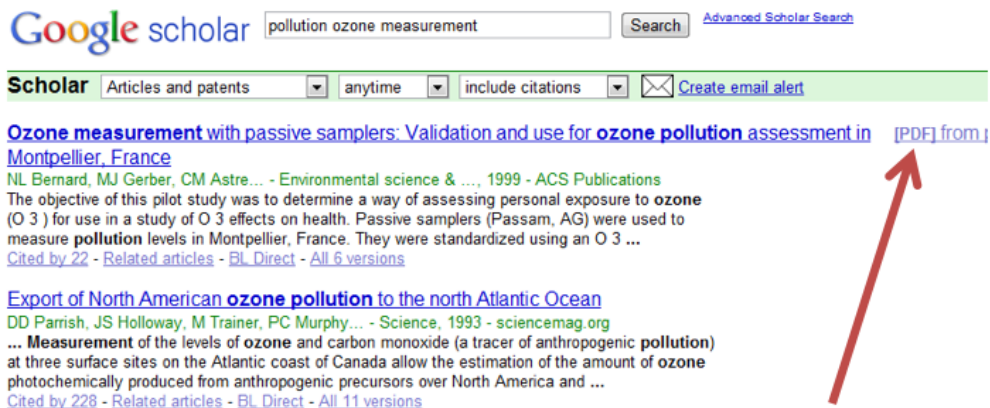
e.g., 1998

<https://scholar.google.com> (Google Scholar)

https://scholar.google.com/#d=gs_asd&p=&u= (Advanced Search)

https://scholar.google.com/scholar?q=atmospheric+ozone+measurement&hl=en&as_sdt=0,45 (Google Scholar search for: atmospheric ozone measurement)

Try many search terms



Google scholar pollution ozone measurement Search Advanced Scholar Search

Scholar Articles and patents anytime include citations Create email alert

Ozone measurement with passive samplers: Validation and use for ozone pollution assessment in Montpellier, France [PDF from:]
 NL Bernard, MJ Gerber, CM Astre... - Environmental science & ..., 1999 - ACS Publications
 The objective of this pilot study was to determine a way of assessing personal exposure to ozone (O₃) for use in a study of O₃ effects on health. Passive samplers (Passam, AG) were used to measure pollution levels in Montpellier, France. They were standardized using an O₃ ...
[Cited by 22](#) - [Related articles](#) - [BI Direct](#) - [All 6 versions](#)

Export of North American ozone pollution to the north Atlantic Ocean
 DD Parrish, JS Holloway, M Trainer, PC Murphy... - Science, 1993 - sciencemag.org
 ... Measurement of the levels of ozone and carbon monoxide (a tracer of anthropogenic pollution) at three surface sites on the Atlantic coast of Canada allow the estimation of the amount of ozone photochemically produced from anthropogenic precursors over North America and ...
[Cited by 228](#) - [Related articles](#) - [BI Direct](#) - [All 11 versions](#)

PDF available

How to Read a Professional Journal

- **Don't try to understand most of it**
- Read the abstract for key words/phrases
- If it is only slightly related:
 - Note the reference and what caught your eye
 - Skip on to the next article
- Skim the figures and conclusions
- Read the Introduction/Background
- Still interested? Read the whole thing.



PhD's in the same field don't expect to understand every word of a journal paper. Some things become clear the more you see them and some things don't matter if they ever become clear because it is a different aspect from your project. Your goal is to become familiar with what people are doing and what might be an interesting project or how it might apply to your project. True Story: Nice projects that have hit the local news with great accolades have quietly sat with little attention at ISEF because the student had no idea what was going on in that field for the last 40 years. Reporters are clueless, judges are not.

Dang! Scooped Again!

- Don't be surprised if it is not an original idea.
- Look through your notes and the articles for a related idea.
- Can you refine the task?
- Can you do a slightly different angle?
- Maybe you can just add to the database with more values.
- Contact the author to see if they have a suggestion. (Check with your teacher first.)

Let's face it, all the low hanging fruit was picked centuries ago. Most research is refining our knowledge not creating totally new knowledge. Out of hundreds of thousands of scientists there are only a few Nobel prizes each year. That doesn't mean that the other scientists are not doing valuable stuff. The same will probably be true of you.

Local Resources

- **Parents, family** (aunts, uncles), **teachers**, etc.
- Universities
- Industry
- Nearby government labs (Health department, water/sewage, environmental quality, insect control, weather, etc.)
- Clubs (Audubon Society, Ogden Astronomical Society, garden clubs, etc.)

Distant Resources

- Email to researchers
- Skype or Google Hangout



Google Hangouts