

CBGS Guide to Scientific Literature Search

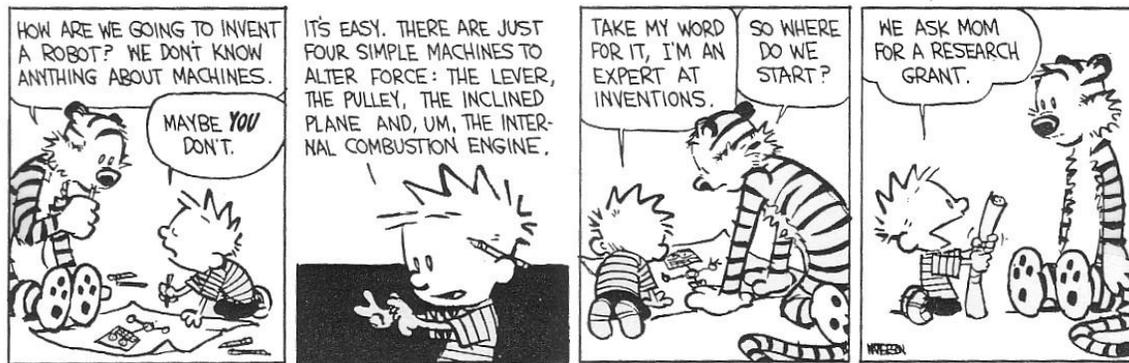
If I have seen farther than others, it is because I have stood on the shoulders of giants.

- Sir Isaac Newton

Scientific research builds on results from previous work. A literature search is how you find giants whose shoulders you can stand on in order to get a better view. ***In preparing for your big research project, it is your foremost job to become an expert in that field!*** This means doing your homework and getting plenty of good knowledge and know-how. On your formal prospectus, your final paper, and your powerpoint talk, you will be judged as much on your understanding, thoughtfulness, and expertise as you will on your actual experiment. Luckily this is the 21st century, where information flows far more freely and easily than anybody could have guessed even a short generation ago. There are many tools for doing a good literature search, some at your fingertips via the internet and some at your nearest university library.

You will need a minimum of **SIX SOURCES** for your prospectus. But first, we need to distinguish between two different kinds of scientific sources:

- (1) **“Primary” or “peer-reviewed” sources** (also known as “refereed” sources) – These sources are called “primary” because they report *actual data and results* from the *actual scientist themselves* who conducted the study. In other words, they are NOT articles written by a “secondary” person who is merely describing or summarizing someone else’s work. Sometimes you can find “primary” data at a government or university website, but most of your primary sources are going to be “peer-reviewed” articles found inside a scientific journal. These are papers *written by scientists* that had to pass inspection by *other scientists* (“referees” ...experts in the field) in order to be published in a special *scientific journal*. Peer-reviewed journal articles will usually bear the same format as the final paper you’ll be writing for your own project: title, abstract, introduction, methods, results, discussion, and lit cited. Our CBGS requirement is to use **AT LEAST TWO** primary/peer-reviewed papers (preferably more).
- (2) **“Secondary” sources** – These are the sorts of source you’re already most familiar with: an article or book or webpage that “secondarily” describes or discusses the results of previous scientific studies. Usually (though not always) it’s written by someone other than the actual scientist who did the work. Some familiar secondary sources are textbooks, most science-oriented websites, and popular science magazines such as *Discover* or *Scientific American*. **ALERT!!!** When using the internet you are looking for **REPUTABLE** scientific sources – preferably websites associated with a **UNIVERSITY** or **GOVERNMENT AGENCY**, or a source that includes a scientific bibliography. Avoid websites that treat the subject matter in a shallow way, or that might not be grounded in good science. Remember, *anyone* can publish *anything* on the internet, whether it’s valid or not. Avoid personal webpages of hobbyists and amateurs. Also, you are **NOT** allowed to cite encyclopedia-style websites such as wikipedia. Wikipedia can be a fine place to get you moving (often with helpful links to other sites, as well as references to primary papers), but do NOT include this as one of your minimum of six sources. **Stick with good, solid, scientifically reliable sites!**



SECONDARY SOURCES

- **Books:** Having grown up in the internet era, you may find it hard to believe that books (made with real paper and ink and everything) are a perfectly fine literature resource. Honest! And thanks to your enrollment at RCC, you have access to just about every book in the civilized world. Some books are “primary” sources, but most will be “secondary.”
 - **RCC Library Shelves:** Go to the RCC Library webpage at www.rcc.vccs.edu. Click the blue “myRCC” button and log on (if you’ve never done this before, click the link below “New to the college?” and follow the instructions from there; you will need your SS#). Now hop back to the RCC homepage and click “LRC/Library” on the left. Then click “College Libraries” on the right. To search RCC’s own holdings (some at Glens, some at Warsaw, some at both), by click on “Library Catalog.”
 - **WorldCat and Interlibrary Loan (ILL):** Through RCC, you can also get your hands on books from most any college in Virginia and from many other libraries across the globe. This is made possible by interlibrary loan (ILL): the RCC library can borrow books via snail-mail from other libraries. To search the holdings at other libraries, log onto myRCC (see above), go to the RCC library page, and click on “WorldCat.” It’s usually best to do an “Advanced Search” using up to 3 Keywords (of course, a single keyword can actually be an exact phrase). You can also change the “and”s to “or”s, which will make your search LESS restrictive. When you find a book that you want, request it through the ILL link or simply by visiting the RCC librarian in person. *Keep in mind that books ordered through interlibrary loan will usually take a week, sometimes two, to arrive.*
 - **CBGS Shelves:** CBGS classrooms at all three sites have a small library of books relevant to environmental science, marine science, and our local ecosystems. See your advisor to check one out.
- **Internet:** Use a good search engine like www.google.com. Bookmark good websites as you go so you can find them again. *Remember: good, solid, scientifically reliable sites ONLY (e.g., university or government websites, NOT Wikipedia and the like)!*

- **Government Websites:** You can often find good background information and/or actual data at a government agency website.
 - **Chesapeake Bay Program:** For Chesapeake-related projects, your best government site is probably that of the Chesapeake Bay Program, a coalition of the three main watershed states – Virginia, Maryland, and Pennsylvania – plus the District of Columbia and the U.S. Environmental Protection Agency (not to be confused with the Chesapeake Bay *Foundation*, a worthy organization, but one with a political agenda that may cause them to slant their science). The CBP address is **www.chesapeakebay.net**. Use the website’s own search engine. *Once you find something of interest, pay attention to the additional links to “Publications” and to “Other sites of interest” (see Oh-So-Helpful Hint below)!*
 - **Other MES-related Sites:** (Use Google to find these.) National Oceanographic and Atmospheric Administration (NOAA ...including their Chesapeake Bay Office: NCBO), Virginia Dept of Environmental Quality (DEQ), the Virginia Institute of Marine Science (VIMS ...including “Advisory Services” for the public and “The Bridge” for students), Maryland Sea Grant, North Carolina Sea Grant, U.S. Fish and Wildlife (USFWS), Virginia Marine Resources Commission (VMRC), Virginia Dept of Game and Inland Fisheries (DGIF), Virginia Dept of Forestry (DOF), Virginia Dept of Agriculture and Consumer Services (VDACS)
 - **Science.gov:** “A gateway to over 50 million pages of authoritative selected science information provided by U.S. government agencies, including research and development results” ...a HUGE website with links to government sources in *all sorts of scientific fields* (and may lead you to primary sources as well)!
 - **USASearch:** The official government search engine ...*a great tool!* The Advanced Search allows you to search specific government domains, such as federal-only, specific states, etc.

IMPORTANT! For each internet source, you’ll need to record the following: Author or Agency (CBP, NOAA, etc.), Year (you can often find this at the bottom of the webpage, as a “Date Last Modified”), Title, Web Address, and the Date that you accessed the webpage.

OH-SO-HELPFUL HINT

Young students often get flustered and frustrated in their efforts to find good literature sources. So know this: someone else has probably already done the work for you! Perhaps the best way to hunt for good sources on the internet is to find just *one* solid site and then *follow the links* from there. Similarly, when you start looking for peer-reviewed articles (see below), a smart plan of attack is to pick a few article titles from the **LITERATURE CITED** section of a book, webpage, or other article. Those articles will have Lit Cited sections of their own, and on and on and on you go. Best trick in the game! Why do it all from scratch?!

PRIMARY SOURCES

On Peer-Reviewed Journal Articles ...please read!

Finding primary sources relevant to your own study will require patience and persistence. Two utterly crucial pieces of advice:

- (1) **Remember, you want papers that genuinely relate to your own project. Please do NOT just grab the first few articles that you find and dump them haphazardly somewhere into your paper. Some papers that you find will be useless to you, and you should trash them. When writing your own paper, your goal should be to RELATE the ACTUAL RESULTS of other scientific studies to your own project. How do their methods and/or data shed light on your OWN proposed study? How are their results meaningful or instructive for your OWN theory and hypotheses? You must make crystal clear the logical connections between their study and your own!**
- (2) **Never forget the Oh-So-Helpful-Hint above! You're a hunter. Once you get on the trail, you should be able to fruitfully track sources from one to the next to the next. Nevertheless this shouldn't be your only search method, for it'll cause you to miss other good sources. Why limit yourself?! The tools below will help you cast a wide net for capturing as many relevant sources as possible.**

Peer-reviewed articles exist in two forms: **Print** (hard copies on a bookshelf) and **Databases** (electronic and online). As you might guess, there's a strong shift these days away from print journals and toward online journals, but the transition is not yet complete. Large research universities pay big, big bucks for online access to almost all scientific journals. RCC, however, is not such a place. We can tap some journals online, but only a fraction of what's out there. However, by virtue of being a taxpaying citizen of Virginia, you can walk into any library at a state-funded (non-private) library and do research. In the CBGS area this includes VCU, William & Mary, Mary Washington, and the Virginia Institute of Marine Science (VIMS). A trip to a college library can be a valuable (if somewhat overwhelming) experience. ***But BEFORE you roll into the W&M or VCU library lobby, you should use the tools below to narrow your search and generate a target list of desired articles. That way you'll go in with a game plan, which will maximize success and reduce frustration.***

In hunting for peer-reviewed articles, use EITHER of the two following strategies:

- Strategy #1** If you CANNOT pay a visit to a university library, then either use "FindItVa" and/or RCC's "EBSCOHOST" (described below) to find articles that are ***immediately available online*** (and free!). The selection may be rather limited, but you can do it in your own living room. You can also try Google Scholar (described below), although most of the articles it links you to will not be available online.
- Strategy #2** If you CAN visit a university library, do NOT use FindItVa or EbscoHost. Instead, skip down to one of the bigger fishing nets such as Google Scholar and/or CSA Illumina (see below) to generate a list of desired papers. And don't forget the Oh-So-Helpful-Hint when building your list!

Casting A Wide Net: Fishing for Articles From Scratch

If you don't already have a particular article that you're looking for, you can search for articles by keyword and/or subject. Here are four vehicles for doing this:

(1) RCC's EBSCOHOST

Good: Will lead you to full-text articles that are immediately available online (although perhaps without the graphs and figures)

Bad: Will NOT find all those other articles that you could get through interlibrary loan or by visiting a college library ...which is a lot!

RCC does subscribe to some online databases (but only a fraction of those available at VCU, W&M, UMW, or VIMS). And now RCC has a single search tool that lets you tap any or all of those databases at the same time. It's called EBSCOHOST. First log on to myRCC (see page #2 above), then go to LRC/Library ...College Libraries. Then click on the EBSCOHOST link. A long list of databases comes up. When a college subscribes to a database, they are really subscribing to a whole collection of individual online journals. Unfortunately, no single database contains ALL the world's journals, so colleges pick and choose the databases that they want to subscribe to. A big university will give you access to just about anything you could ever want, but RCC's subscriptions will be much more limited: sometimes full-text articles, sometimes only abstracts, and sometimes nada.

Now, you can select just one particular database, or several at once:

- Academic Search Complete (a biggie, accessing a broad selection of journals)
- Environment Complete and GreenFile (scroll down) for ecology, enviro science, and agriculture projects
- PsychARTICLES, PsychINFO, and the Psychology and Behavioral Sciences Collection for a psychology project
- Education Complete and ERIC for topics in education (e.g., for a psych project related to student learning)
- Health Source and Medline for health and medical topics (incl. veterinary)

Alternatively, you can just "Select All," in which case the search engine may run a tad slower (and might return a bunch of stuff you don't want), but at least you won't miss anything. Continue.

- ✓ Smart Advice: Search using up to 3 keywords (of course, a keyword can actually be an exact phrase). Connect your keywords with "AND" or "OR." **Important:** using "AND" is actually more limiting and restrictive, because it will return *only* those papers in which *both* keywords are present. Using "OR" gives a broader, looser search, returning *all* papers that contain *either* keyword. *It's often better to use "OR," since "AND" can cause you to miss articles of interest!*
- ✓ Good Advice: When seeking articles on a particular species of plant, animal, or microorganism, use the scientific genus and species name rather than the common name. For example, use *Crassostrea virginica* instead of Eastern oyster.

- ✓ Not Bad Advice: You can limit your search “Peer-Reviewed” articles (just check the “Scholarly Journal “ box), which is probably what you’re looking for right now. However, you may be missing other general or non-scientific articles on your subject. *It’s not a bad idea to start with an unrestricted search, just to see what you can find, and then afterwards do a second search restricted to peer-reviewed articles.*
- ✓ Shaky Advice: You can also limit your search “Full Text” articles. This way you’ll only get complete articles that are *immediately available online*. But you will be missing out on a lot of Abstracts (author summaries) from other good papers that you could still get by visiting a university library (or through RCC’s interlibrary loan).
- ✓ RESULTS: Click directly on a title for publishing info plus the Abstract, or else click the “Full Text” link to go straight to the article itself (if it’s available online).
- ✓ Hint: As you initially skim the list of articles, click the “Add to folder” link under each of those that sound promising. Then once you’ve gone down the whole list, go back upstairs and click the “Folder” button. It’ll take you to all the articles that you flagged.
- ✓ Suggestion: Don’t read papers as you find them (although you may want to glance at the Abstracts). Instead, spend plenty of time sweeping your net to learn what’s out there. Then later come back for a careful look at the more promising papers.
- ✓ Another Suggestion: Save the PDF’s to your hard drive or a flashdrive, to print and/or read later. This is smart! That way you won’t lose the publishing info, which you’ll need to cite when you write your own paper.

IMPORTANT! For each useful paper, you’ll need to record the following: Author(s), Year, Title, Journal, Volume #, and Page Numbers. But do NOT copy and paste the publishing info straight from the webpage into your paper. You’ll have to cite sources using a special format (for us and for VJAS), and the one they use online ain’t it!

ALERT! It is utterly inappropriate to cite a paper as a source when all you did was read the Abstract. **DON’T DO THIS!** Remember, the goal is to meaningfully relate the work of other scientists to your own study. How can you possibly do so based only on an abstract?! You need to review the article itself, especially the Graphs, Figures, Results, and Discussion.

(2) Find It Virginia (www.finditva.com)

Good: Will lead you to full-text articles that are immediately available online (but often without the graphs and figures)

Bad: Will NOT find all those other articles that you could get through interlibrary loan or by visiting a college library ...which is a lot!

Find It Virginia is a network of subscriptions held collectively by our local public libraries. To use this tool you'll need a library card. Go to www.finditva.com. Select your local library and enter the barcode # from the back of your library card. Your best bet is the "Power Search," which will plumb multiple databases at once.

- ✓ Smart Advice: Instead of a Basic Search, always do an Advanced Search. Search using up to 3 Keywords (of course, a single keyword can actually be an exact phrase). Connect your keywords with "AND" or "OR." **Important:** using "AND" is actually more limiting and restrictive, because it will return *only* those papers in which *both* keywords are present. Using "OR" gives a broader, looser search, returning *all* papers that contain *either* keyword. *It's often better to use "OR," since "AND" can cause you to miss articles of interest!*
- ✓ Good Advice: When seeking articles on a particular species of plant, animal, or microorganism, use the scientific genus and species name rather than the common name. For example, use *Crassostrea virginica* instead of Eastern oyster.
- ✓ Not Bad Advice: You can limit your search "to peer-reviewed publications," which is probably what you're looking for right now. However, you may be missing other general or non-scientific articles on your subject. *It's not a bad idea to start with an unrestricted search, just to see what you can find, and then afterwards do a second search restricted to peer-reviewed articles.*
- ✓ Shaky Advice: You can limit your search "to documents with full text." This way you'll only get complete articles that are *immediately available online*. But you will be missing out on a lot of Abstracts (author summaries) from other good papers that you could still get by visiting a university library (or RCC's ILL).
- ✓ RESULTS: Underneath each article you'll see one of two links: either **Abstract** or **Full-text**. If it says Full-text, click to get the complete paper online (although it may omit graphs and figures). If it says Abstract, you can only read the author's summary of the paper (although this might be enough to tell you whether you wish to pursue the paper at a university library or through RCC's ILL).
- ✓ Hint: As you initially skim the list of articles, check the "Mark" box beside those that look interesting. Then once you've gone down the whole list, go back upstairs and click "Marked Items". It'll discard all the ones you didn't want.
- ✓ Suggestion: Don't read papers as you find them (although you may want to glance at the Abstracts). Instead, spend plenty of time sweeping your net to learn what's out there. Then later come back for a careful look at the more promising papers.
- ✓ Another Suggestion: If possible, save the good articles to your hard drive or a flashdrive, to print and/or read later. This is smart! That way you won't lose the publishing info, which you'll need to cite when you write your own paper.

(3) Google Scholar: On the Google homepage, click “More ...Scholar”

Good: A very wide net for fishing for professional papers. What’s more, it gives great links from one paper to another (à la the oh-so-helpful hint above). It also ranks each paper by how frequently it’s been cited by other scientists in the field ...which gives you a sense of how important the study was.

Bad: Although some of the papers here may be immediately available online, most probably will not. You’ll have to visit a university library (or else use RCC’s interlibrary loan, which takes a couple weeks).

- ✓ **Great Advice:** Underneath each paper you’ll see “Cited by...” a certain number of OTHER papers. Click on this link and it’ll list those OTHER papers as well. You’ll also see a link to “Related Articles.” Now you’re on the trail from one paper to the next to the next!
- ✓ **RESULTS:** Click on a paper’s title to see if you can get the paper online. In many cases you’ll at least get the Abstract.

(4) Cambridge Scientific Abstracts (CSA Illumina) (via RCC webpage)

Good: Will find the titles of LOTS and LOTS of articles, and also let you read their abstracts, allowing you to choose the ones you want to pursue by visiting a university library (or through RCC’s interlibrary loan).

Bad: Will NOT give you immediate online access to any articles. You’ll have to go to a university library (or use RCC’s ILL).

You’ll want to access CSA through RCC. Log on to myRCC (see page #2 above), then go to LRC/Library ...College Libraries. Underneath “Articles” on the RCC library homepage, click “More” and then scroll down to “Cambridge Scientific Abstracts.” Here again, you may want to do an Advanced Search, and you may want to specify a subject area.

- ✓ **RESULTS:** If any title looks interesting, hit “View Record” to read the paper’s Abstract. You can also “Mark” the interesting ones, and then once you’ve gone through the whole list, click “### Marked Records” in the upper right corner of the webpage. It’ll discard all the ones you didn’t want.

How to Get an Article When You ALREADY Know the Title & Journal

Suppose you already know the name of a particular article that you want and the journal that it's in (for example, maybe you found it in the Lit Cited section of another paper, using the oh-so-helpful-hint above). It might be possible to access it online through RCC's EBSCOHOST or through "Find It Virginia" (see above). Click Power Search, then click "Publication Search," type in the name of the *scientific journal* (not the article itself!), and search. If it's available online, you'll be able to navigate right to the paper ...usually by selecting the year of the article, followed by the issue it's in. Be aware, however, that many journals have been around for decades, and some haven't yet put all their volumes into electronic format. Online articles may only go back so far.

- If that journal is NOT available to us online, then you can still get it through Interlibrary Loan (ILL) at RCC. But it takes time, usually a week or two.
- (You could also try Google Scholar to see if you can get it online. See above.)
- Alternatively you can actually visit a university library such as W&M, VCU, UMW, or VIMS. Before you go, you might want to check and see whether they actually carry that particular journal, either in print or through an online database.
 - ◆ **W&M (and VIMS):** To check availability at W&M, go to www.swem.wm.edu and click on "Library Catalog." Type in the name of the journal and click the "Periodical Title" button. If your journal comes up, click on "Details" to see which years are available online through "Electronic Access" and which are available in print under "Holdings." (Note: be aware that VIMS is a part of W&M, and some journals may be at the VIMS campus at Gloucester Point rather than the main campus in Williamsburg.)
 - ◆ **VCU:** To check availability at VCU, go to www.library.vcu.edu and click on the "Journal Finder." Type in the name of the journal, select "E-Journals and Print," and search.
 - ◆ **UMW:** To check availability at Mary Washington, go to www.umw.edu/library and search for your journal with the "Journal Finder."

Visiting a University Library (Virginia public colleges only; not private)

Again, if you're willing and able to make a trip to a university library, it's a good idea to build a healthy list of desired papers BEFORE you go (e.g., using Google Scholar and/or CSA Illumina). The libraries should have some public computers that are available to everybody (as well as other computers that require a login, hence useable only by university students). *However, be aware that these public computers will probably not be hooked to a printer, so if you want to take home copies of electronic articles, bring a flashdrive!* For print articles off the shelf, a copier should be available, but it'll probably cost a dime or so per page. You might want to call ahead to ask about hours of operation and copier availability. *When you get to the library, ask a librarian to help you get started! They like to help!* There will be lots of databases to choose from, but the

librarian can help you select the best ones for your particular topic (also, there will probably be a “global” search tool that will hunt through many or all databases at once.