Using Scientific Literature

In this initial exercise you will learn more about searching the scientific literature. You need not follow the standard format for labs for your report (this applies to this report only). Next week’s quiz will include material from this discussion.

Goal

The goal of scientific research is to produce new knowledge that others may use. Performing a literature search can save you much work and even embarrassment in the long run. Google, Wikipedia and other similar resources are very useful. However you need go beyond these for serious scientific research.

Why We Need Peer Review

This video presents an outstanding explanation of why media reports of science are often completely wrong. This is why we need the scientific peer review process.

Watch: Scientific Studies: Last Week Tonight with John Oliver (HBO)
https://www.youtube.com/watch?v=0Rnq1NpHdmw

Structure of a Typical Scientific Paper

- Although each scientific paper may be a little different, most papers follow the following template.
- Abstract
- Short Introduction describing the purpose, relevant theory and derived equations.
- Experimental with a short description of the apparatus and procedures.
- Results including sample calculations, tabulated results with error bounds.
- Conclusions with a discussion of error, precision and accuracy as appropriate. Compares results with any other available literature values and discusses error and accuracy.
- References. A citation of all sources including books, peer reviewed journals and the internet.
Peer Reviewed Scientific Journals

Peer reviewed scientific journals remain the most important source of information for scientists. Examples include the New England Journal of Medicine, Nature, Science, the Journal of the American Chemical Society. Peer review refers to the process where papers are submitted to journals. The papers are sent anonymously to other scientists who review the papers for importance, errors, length, readability and other things. Reviewers make recommendation to editors who reject or accept them depending upon the reviews. Peer review is the “gold standard” of the scientific process although mistakes are often made. It does not guarantee that the paper is correct but it catches obvious errors and fraud (usually)

Other Primary Sources

Preprints (papers sent to journals and under peer review are now often available before their acceptance by journals but beware! Some many never appear due to errors found during peer review.

The “Gray Literature"

- Masters and Ph.D. Dissertations
- Government Reports
- Proceedings from scientific meetings
- Patents

Secondary Literature

The secondary literature presents results that are compiled from the primary sources. Textbooks are a form of secondary literature with which you are probably most familiar. Other important sources include indexes and abstracts. These include sources such as Chemical Abstracts, Medline and Web of Science. Other excellent sources include review journals such as Chemical Reviews and Reviews of Geophysics; and data collections such as the CRC Handbook.

Chemical Abstracts and SciFinder Scholar

Chemical abstracts is the most respected source of chemical information and guide to the literature. The print version began in 1907 and the electronic version began in 1967. It covers almost anything in the primary literature that can be construed to be new research in chemistry or chemical engineering. This means that it also includes much about the literature in biology, environment, geology, materials, medicine and physics. Coverage is global and it tries to include all languages. You can search it in many ways including by keywords, title and authors. SciFinder Scholar is an electronic version of chemical abstracts.

MEDLINE® (Medical Literature Analysis and Retrieval System Online)

MEDLINE is a leading bibliographic database for medicine, medicinal chemistry and the life sciences. Given the
importance of chemistry for medicine, MEDLINE includes a significant amount of abstracts in most areas of chemistry. An advantage of MEDLINE is that it’s free and available to the general public. MEDLINE contains citations of over 15 million journal articles. It begins in about 1950 (there is some older material) to the present. There are citations from approximately 5,000 journals in 37 languages. MEDLINE is a subset of PubMed® which is, in turn, one of the databases provided by US National Library of Medicine ‘s National Center for Biotechnology Information (Source US National Library of Medicine website; see below).

Instructions for MEDLINE®

1) MEDLINE: Go to the US National Library of Medicine (National Institutes of Health) website:
http://www.nlm.nih.gov/

2) Go to PubMed in upper left-hand corner.

3) Try an author search first. Type a name of one of our faculty in the search box at the top and submit. If no articles appear try again. If too many appear try a list of two names or more. Now you will find fewer citations. For example suppose that you are looking for a paper written by Fujita AND Stockwell. Arrive at a more reasonable number of abstracts. View one of the abstracts by clicking on its title.

4) Now try a subject search. It works just like the author search.

Google Scholar

A Google search engine focused on the scholarly literature. Works mostly like Google; see the site at:
http://scholar.google.com/

American Chemical Society

To see a list of journals published by the ACS go to: http://pubs.acs.org/action/showPublications?display=journals
Search these journals at: http://portal.acs.org/portal/acs/corg/content

Science - American Association for the Advancement of Science

http://www.sciencemag.org/

Beware of Science Fraud

Approximately one published scientific paper per day is retracted due to some form of misconduct that ranges from plagiarism to fabricating results. Two percent of scientists say they have fudged their data in publications. Do not commit fraud in your laboratory reports or during your professional career.
Read: What’s Behind Big Science Frauds?
By Adam Marcus and Ivan Oransky May 22, 2015 in the New Your Times.
http://www.nytimes.com/2015/05/23/opinion/whats-behind-big-science-frauds.html?_r=0

Assignment - To Do

In this initial exercise you will perform a literature search by using an online abstract service. Most operate in more or less the same way. Given the health profession orientation of many in our class you can use MEDLINE® OR the other sites listed above.

Complete Table 1

Complete Table 1 using MEDLINE to perform the search, or use or another one of the databases listed above. Be sure to put you name and the database you used and write down how many citations you find for your search.

Table 1. Subject / Keyword Search Results – The quotes are necessary where shown.

<table>
<thead>
<tr>
<th>Search Term</th>
<th>Number of Citations</th>
</tr>
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<tbody>
<tr>
<td>Thermodynamics</td>
<td></td>
</tr>
<tr>
<td>“Quantum Mechanics”</td>
<td></td>
</tr>
<tr>
<td>Enzyme</td>
<td></td>
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<tr>
<td>Protein</td>
<td></td>
</tr>
<tr>
<td>Thermodynamics AND Enzyme</td>
<td></td>
</tr>
<tr>
<td>“Quantum mechanics” AND Enzyme</td>
<td></td>
</tr>
<tr>
<td>Kinetics</td>
<td></td>
</tr>
<tr>
<td>Kinetics AND Enzyme</td>
<td></td>
</tr>
<tr>
<td>Kinetics AND Thermodynamics</td>
<td></td>
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<tr>
<td>Spectroscopy</td>
<td></td>
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<tr>
<td>Spectroscopy AND Enzyme</td>
<td></td>
</tr>
<tr>
<td>&quot;X-Ray Crystallography&quot;</td>
<td></td>
</tr>
</tbody>
</table>
Hydrogen Peroxide

H2O2

Discuss the Results for Table 1.

Notice that many of the searches in Table 1 are linked, such as the search for Enzyme and the search for Thermodynamics AND Enzyme. Write a paragraph that discusses the differences between the connected search terms. Include in your report.

Find a Paper by Using a Search Strategy

The best databases include links so that you can download papers. However costs are usually involved. Howard University has several subscriptions that are free to you when used within the university. Come up with a total of three search terms. These may be authors or key words or some combination of these and list in the Report section. Use the search terms to find a recent research article in a primary peer reviewed journal. You many need to revise the search terms depending on your results. Try to find a paper that includes all or most of the standard paper components that we discussed in class (Abstract, Experimental (or methods), Results, Discussion and References). Do not worry if the paper does not contain an Appendix because its not included in the typical paper. Download the paper to your computer.

Each student will find a unique paper. You must use a defensible search strategy; just using a paper that you happen to have does not count.

After you find a paper, Reseserve It by writing down its reference on the reservation sheet on my door.

Write a Paragraph Explaing Your Search Strategy

To get credit for this part you must successfully explain in your report how you found your paper from the databases. From your report I need to be able to find it from your description.

Include in your discussion a list of your search terms such as:
Term 1. Thermodynamics; Term 2. Kinetics; Term 3. Enzyme

Discuss the Paper Briefly

For the primary research paper that you found discuss its format. How well does it present its results? I am not looking for a detailed review, just a short assessment that should be expressed in two or three paragraphs. If you were the reviewer would you recommend major changes (why or why not)?

More Questions to Answer in Your Report

1. What is the difference between the primary and secondary scientific literature?
2. Discuss the differences between a paper in a peer-reviewed journal, a review article and a textbook.
3. Given the same paper, would scientists believe it more if it were published in Nature or a Federal Government Report? Why?

4. Discuss the peer review process. What are its virtues? Can you imagine any serious problems and deficiencies?

5. Suppose you are new to a specialized research area but familiar with the overall subject. Would it be better to begin your search with a paper in a peer reviewed journal, a review article or a textbook? Defend your answer.

6. Compare the Example Databases to Google and the Wikipedia. What are their relative strengths and weaknesses?