How to read, comprehend and critically evaluate Scientific Journal Articles

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Textbooks vs. Journal Articles

- Understand that a Scientific Journal article is NOT the same thing as a textbook!
- Textbooks deal with generalities and serve to give a basic understanding of the subject matter. This could be considered a summary of all known matter on each topic represented.
    - Reading and understanding textbook material is only the beginning of the scholarly skills needed in graduate school.
    - You need to LEARN the book.
- Journal articles are written to communicate results from scientific experiments and the interpretation of those results represents that scientists views.
    - You need to KNOW the literature.
- Although journal articles go through a "peer review" process, this does not mean that each article should be taken as "law" or blindly accepted.

Why you need to "Know the literature"

- To conduct research, a scientist must gauge what is already known about his particular field, how the field interprets/views this information, what the critical issues are and how to address them.
- A scientist should read the primary literature to assess the field and challenge it. It is important to learn how to argue, critique and present current literature in order to move your own research forward.

Reading for Understanding

- The purpose of reading a journal article is not to "learn" definitions, concepts, and key figures in the history of science!
    - Gobble, Swallow Whole, Digest!
- The purpose of reading a journal article is to critically evaluate the work, results, and interpretations being presented. You must think about what you are reading, as you are reading it.
    - Bite, Chew, Vomit!

Working Smarter not Harder!

- Often students are faced with a never ending trail of journal articles to read and it may feel like there is no way to read everything and take it all in! Trying to read everything will make you feel overwhelmed AND you won't retain any of what they read.
- Know your limitations and realize that you cannot read everything, but you can read the most important papers and understand them.
    - When faced with a pile of articles to read, learn to identify which ones have the most critical information and made the most impact in the field. Spend your time on these.
- When faced with a particular article, learn to identify the most critical information and spend time understanding that. You do not have to read every word in the whole article (Remember, this is NOT a textbook!)

Don't try to mow *all* of the lawns in the *whole* neighborhood as *quickly* as possible. Instead, pick the most important lawns and take your time making sure the job is done right so that you can earn a tip!

SUGGESTED Reading Order

1. Abstract
    a. The author was given this finite space to "state their" case with the reader.
        i. FROM THE ABSTRACT ALONE You should be able to: identify state the study's objective, describe the methods , summarize the results and state the conclusions.
    b. The MOST IMPORTANT section of the paper! If you invest time extracting information from the abstract, then when you read the rest of the paper, it will all be familiar to you!
2. Figures and Tables
    a. Read the figure legend and write labels in the graph. Use color and draw lines!
    b. Identify the key result in each figure.
    c. Think about what this figure tells you in relationship to the studies objective.
3. Introduction
    a. Identify the critical concepts and definitions they used to build up to the primary research question.
        i. This is important because operational definitions are specific to each experiment.
    b. Consider the primary research question.
        i. Is the question hypothesis driven to determine how/why a relationship exists>
        ii. Is the question exploratory in nature or to evaluate a method?
4. Discussion
    a. Describes HOW and WHY the study was conducted.
        i. What variables/subjects were included/excluded,
    b. Offers justification for the conclusions drawn.
    c. Describes the studies relevance to the field in comparison to previously published articles.
5. Results
    a. Identify the critical experiments that decide an important question.
    b. Identify the experiments that support the critical experiment and why these were done.
    c. Identify the control experiments (positive and negative) and what they prove.
    d. Understand what the critical results are and how they can be used to draw conclusions.
6. Methods
    a. What are the critical methods used in the study?
        i. What kind of information can be gathered from that method?
        ii. Are there other ways to perform this method?
        iii. Can other methods obtain the same information?
    b. Consider the subjects, chemicals, and drugs used with same questions.
7. References
    a. Yes you must read the references section!!! But this is to your benefit! If you are trying to "know the literature" this section is extremely valuable to you!
    b. Take note of the authors names for each paper. Generally the last name listed is the PI and tells you whose lab the work was conducted in. If you start to see that name listed last in multiple papers, this person may be one of the "heavies" in the field.
    c. Critically evaluate the titles and the year. Think of them as punch lines for each paper listed. If it is important to the field, this may be a paper you need to consider for further reading.
    d. Always pick out at least 3 references to look up in pubmed and print the abstracts out. Attach these to the article you just read as background reading. You may also want to pick 1 review from the references to read if the subject matter is relevant to your field.

What is YOUR interpretation?

- Now that you have critically read the article, are you convinced of their argument?
- Where there any logical or methodological weaknesses? How could these be addressed?
- What new problems are suggested by these results? Impact on the field?
- Importantly, think about how this work affects your research.