

Here I explain how to read a scientific paper. I give questions which you should ask yourself when reading the different sections. The questions may not be incomplete but it is a starting point to learn how to be critical of scientific literature.

I also give some tips on how to continue reading relevant papers in order to learn about your field, its researchers, and the different approaches and methods that are used.

I am assuming a scientific paper that follows the IMRaD structure. Some journals don't follow this structure closely. You may have to refer to "Supplementary Information" for a complete understanding of the methods and additional control experiments. Sometimes you will have to refer to other articles for a detailed description of methods.

Reading Original Scientific Literature

The main message that you need to know when beginning to read scientific literature for your research is that it is never the final word on a subject.

Science is an ongoing process of investigation. This means that sometimes the content of an article, or the cited papers it relies on, may be superseded by better evidence, later. It's reproduction of research results, and the culmination of many lines of investigation that crystalize the understanding of a phenomenon.

Acknowledge but don't be too trustful of articles that underwent peer review. Neither the authors nor the peer reviewers are infallible. The set of peer reviewers and editors that judge the reported work prior to publication is limited in number and expertise. Papers can be retracted for reasons the peer reviewers overlooked.

Only by constantly reading will you get a good overview over your field. It is important to read many articles on a subject from different researchers to become an expert in the field, and to be able to understand the explanatory power and limitations of its research approaches and methods. It is also important to take note of how different researchers think about a problem.

Don't be afraid of forming your own opinion, early. You should be constantly asking yourself critical questions about the work that you are reading. Even if you are still at the beginning, it is important to constantly practice to be critical (not dismissive!) of research articles. And at the same time you need to be open to update your own understanding with new evidence.

The goal of literature research is to build strong conviction about a topic, but hold it loosely.

How to Pick and Read a Scientific Research Report

You may have received a list of recommended introductory readings by your adviser. If you are on your own, you may have started to search for papers in the databases holding research papers of your field. Either way, the amount of possible starting points is overwhelming.

Choose the first article to read by its title.

In most research articles the title already gives you the main conclusion.

“Does the title sound both relevant and interesting?”

Throughout reading the paper you should keep this take-home message in mind. It is, after all, what the researchers want you to accept as a new piece in the puzzle that is your personal working model on the subject.

TL;DR: The Abstract

The abstract gives you a very brief overview over the reported study. You can think of it as a whole research paper in 5 tweets.

“Are you still interested?”

It makes no sense to continue reading when after having a look at the abstract you figure that it may not be as relevant to you as you first thought. Unless it's a mandatory read for some reason.

Introduction

The function of the introduction is to introduce the topic from the author's perspective and to explain how the researchers arrived at their research question, hypothesis, and experimental design.

It usually begins by framing the general context of the paper (the “big picture”). You may find the topic interesting and relevant for other reasons, but it is important to understand where the authors are coming from.

The scope of the introduction will then narrow down as the authors lead the reader towards their research question. Note that this is not a historical report of how the researchers themselves

arrived at the question, nor does it give you a complete overview of what is known about the topic.

A well written introduction will give you **exactly the information you need to know** to arrive at the research question.

“Do you find the introduction compelling, the line of thought convincing, and does the research question really follow from the information you were given?”

Take note which papers were cited for the most relevant and interesting pieces of information that were given in the introduction!

The Details: Results and Methods

Start with the results. Read closely to understand which experiments the researchers conducted, and look at the figures and the descriptions to understand the data.

“How did the main experiment test the hypothesis, and which additional tests (control experiments) did they do to eliminate possible alternative explanations for the outcome?”

To understand better why the researchers interpret their data in a specific way, check the method section.

“Are the methods appropriate? Did they collect sufficient data? Were they careful to consider the limitations of their methods?”

Updating the State of the Art: The Discussion

Goal of the discussion is to put the new findings in context with the existing literature. The authors discuss different aspects of their findings, and compare them with earlier evidence.

“Do the findings agree or disagree with previously described evidence and interpretation? Do you agree with the authors’ conclusions and suggested updated model?”

Further Readings

While reading, take note which claims were crucial for the development of the authors' questions and hypotheses, and which you found particularly interesting or relevant to your own work. You can then follow the citations in your further reading.

You can also find out which later papers cited the paper you just read, for example by searching for the paper on Google Scholar. The search results will provide a "cited by" link.

Quick Reading

Once you understand the methods and lines of investigation in your field, and can connect them with researchers, reading will become much quicker. Since science is an iterative process, you will begin to recognize concepts you already know about and understand.

Well written scientific research papers will follow a simple rule, where the first sentence in a paragraph states the claim that is substantiated in the rest of the paragraph. If it's something new, or a standpoint different from your own, you should read the paragraph, but if it merely confirms your knowledge it may not be necessary.

Advanced Reading

If you are well informed about the research field you are reading about, you can begin being more picky. In this case you want to read the title and abstract, and then jump to the conclusions all the way at the end, and have a look at the figures. From this initial overview you go to the parts of the paper that you still feel like you need to have a look at.

But I can't stress enough that this is not how a beginner should start out. It is a strategy that eliminates having to read things you already know and things you aren't interested in. But in order to know this, it takes experience. You will probably start doing this intuitively at some point. I put this in here so you know it is okay to do so.