Guide to Reading Scientific Articles
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One of the most important tasks of a scientist is to read and critique scientific articles. But it's not easy! Scientific papers differ stylistically from other types of writing, they can be fairly technical, and sometimes they contain jargon. All of these factors can make scientific articles intimidating when you're first starting out. There are many different strategies for reading papers, and you will continue to develop these skills throughout your career (check out some perspectives from people at different career stages here).

Here, we'll break down (1) the reasons we read; (2) the different types of papers you might encounter; and (3) basic strategies for understanding a paper.

(1) Why do we read scientific papers?

- Gain background knowledge about our area of study. It's important to read the classic papers and more recent papers. This helps us understand the history and trajectory of our field.
- Learn about important new discoveries in our field.
- Get ideas that can inspire our own work.
- Critique the work of others and hold others accountable. We want to make sure that authors are conducting good research that is reproducible.

(2) Articles come in different styles. Here are the main types you will encounter:

- Original research articles
  - These report original research projects that address a specific question, or set of questions. They may use experimental, observational, and/or modeling approaches. These papers usually follow the 'standard' format and include the following sections: Abstract; Introduction; Methods; Results; Discussion.
- Review articles
  - These papers aim to summarize key findings that have emerged in a specific field of study. Stylistically, they do not usually follow the same format as original research articles. Instead, they tend to be organized into subsections with informative subtitles. Review articles can be a great place to start when you are interested in learning about a new topic because they explain the major findings.
- Meta-analyses
  - These papers aim to address a research question by *combining* the results from many different original research articles. The idea is similar to a review paper, but in a meta-analysis, the authors will use statistical methods to combine the results

from many smaller studies to increase sample sizes and test whether findings generalize across study systems. Meta-analyses are becoming more common in ecology, as biologists around the world attempt to share data to better understand global biodiversity trends and large-scale ecological processes.

- Perspectives and opinions
  - These papers describe interesting ideas that might spark new areas of inquiry. They may not be fully supported with data yet, and so they are typically short.

One of the biggest frustrations when embarking on a scientific literature search can be figuring out how to read different styles of papers. On top of that, different journals often have different formatting requirements that can make papers look quite different. For example, sometimes the methods are stuck at the end of the paper. While this can be frustrating, try not to get bogged down in these stylistic and formatting differences when reading and critiquing papers. **Focus on the objective of the paper you're reading, and ask yourself if the paper clearly addresses that objective.**

(3) Basic strategies for reading a scientific paper

- Start with the **Abstract**. A good abstract will give you a synopsis of all the important parts of the paper*: What motivates the study? What is the specific research question? What methods are used? What are the key results? And what does it all mean?
  *Keep this in mind when you write your own abstracts!

- Next, read the **Introduction**. This should give you an overview on the general topic, and some context for what motivated this particular study. Sometimes the last paragraph of the Introduction will lay out the specific objectives of the paper.

- Skim over the **Methods/Results** if they are full of jargon. Try to pull out the main approach and findings, without stressing about every detail. You can always return to these sections later, once you have a better understanding of the whole paper.
  - It is often more useful to focus on the **Figures** and **Tables.** What does each figure show? Check what the x- and y- axes are and try to explain the trends.

- The **Discussion** should put the research into the bigger picture context, and provide some interpretation of what the results mean. Sometimes, authors will start the Discussion with a paragraph that summarizes their findings.

- **Don't get bogged down in the details!** Science papers can be technical, and no one expects you to understand every detail. This is an important tip for tackling the Methods and Results sections if the authors use protocols and statistical analyses that you are

unfamiliar with. A good paper *should* explain what the methods are testing, even if the details are more catered to an expert.

- Be an **active reader**. Highlight important sentences, write down any questions you have (big-picture or detailed-oriented), Google terms you're unfamiliar with, and come to class ready to ask questions and share your opinions with your peers.