Module 1.3: Learn - Professional Development

1.3 Professional Development

Recommended steps for quickly evaluating a scientific paper

One key skill for research science that we will be learning about in depth in this course is the scientific article, also called a paper, a manuscript, and primary literature. Being able to comprehend and critically evaluate scientific articles is foundational to any scientist's future. In order to establish and improve your ability to read and understand a scientific article, we will describe ways to read a paper, all the sections of a paper, and even have you write in the format of a scientific article so you can understand what goes into it first hand.

This table briefly summarizes the main sections of a paper and recommends an order to evaluate if the paper is pertinent to your needs. It's worth mentioning that not every paper is set up the same way and recommendations can vary based on the field of science, but once you have a general idea of what is meant to be in a paper, you can more easily adapt to the different formats you encounter.

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Part(s) of paper and what order to read them	Questions to answer
• **Start with the title and abstract.** If there is one universal recommendation, it's start with the title and abstract. Here the author has intentionally summarized all of their key findings and methodological approaches in one short paragraph.	• What is the purpose of this paper? • Is it introducing new methods or tools to solve a problem? • What topic does it help me understand?
• **Skim the introduction or background** to see if there are things you want to know more about. The introduction will	• What is currently known about this topic? • What blanks were the authors hoping to fill in?

present what is currently known about topics being discussed in the rest of the paper. You can use this section to help you learn important specifics, which will be more important if you are new to a field.

- **Critically evaluate the figures.**
  The figures and their legends (captions) are integral to understanding the experimental design and the results. Figures are essentially the evidence for the claim(s). If the figure legends have a title in bold, that is often a great summary of what the figure is meant to demonstrate.
  - How was this figure generated?
  - What data does the figure actually show?
  - What conclusion is drawn from this figure?
  - Is there anything that seems unexpected or confusing?
  - What key findings does the paper present?

- **Review the discussion.**
  This will usually start with a summary of the paper and end by presenting what the authors were not able to figure out as future directions. This section sometimes notes important caveats that you might not have thought about and gives you ideas of what might come next.
  - How did this work make an impact in the field?
  - Am I doing anything they state as a future direction (if so I can use this paper in the introduction of my future papers)?
  - How did they interpret the results? Do I agree with their interpretation?
  - Is this what they said they would do?
  - What are the next steps I would take if I were the author?

- **Check the methodology**
  This section details all of the assays, techniques, and samples used to make the results discussed in the paper. For computational research, this section includes the software or packages used, mathematical models, and workflows used. Think critically about the steps they took and if they make sense. Look for specific parameters and resources that might be relevant to your own research; you might need to email the corresponding author if you have specific questions while trying to implement things for your own work.
  - What exactly did they do?
  - Were the materials or model systems appropriate for what they were trying to study?
  - Do the methods make sense for the question being asked?
  - Can I use any of these methods to improve my own research?

• **Reread the entire paper and take notes.** If you made it this far, you probably found the paper insightful or pertinent; time to go back in, take notes, and develop your understanding if you have the time.	• Was there anything you missed the first time? • Are there topics or sections that are still unclear?
• **Check for supplementals.** This section can include large tables of clinical and genomic data, analysis used to determine parameters and models used in the main results, and figures that are important but there wasn't enough room in the main text. It's typically worth that extra look to see if there is anything you can use to bolster your own work.	• Did this article have supplementals? • What was the purpose of each? • Is there data that I can use to run with the approaches we developed?
• **Check out the references.** You can typically use this section to find more papers that are relevant to the specific aspect of the work that drew you to this paper in the first place. Papers cited can also give you an idea of other researchers in the field that you can check out.	• List two other references from the list that seem relevant based on title alone

Table. Steps to read a scientific paper and questions to ask.

There is also this article from **PLOS Computational Biology (https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008032#pcbi-1008032-t001)** that gives some good rules:

Ten simple rules for reading a scientific paper | PLOS Computational Biology (https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008032#pcbi-1008032-t001)

Journal Club: Original paper on the CCLE

Since our research project centers around the CCLE data set, we would like you to apply the techniques for paper reading above to read the original publication showcasing the CCLE data set and speaking about what they learned when they first analyzed it as well as how they feel it can be a good resource for researchers like us.

https://www.nature.com/articles/nature11003 (https://www.nature.com/articles/nature11003)

As you read the manuscript, think about the following questions:

1. Why did the authors want to generate this data set?
2. How did they generate the CCLE data set?
3. What evidence do they present for their conclusions?
4. What results or resources are they contributing to the scientific community?

To conduct journal club discussions for class, we have set up assignments on Canvas that use the Perusall application to display and comment on the manuscripts we would like you to read to understand the project better. If you have never used Perusall before here are two short videos to help you get started:

- Accessing Perusall through Canvas (https://www.youtube.com/watch?v=bs_Z_3wqib4) (Accessing Perusall From Within Canvas Video Transcript (https://docs.google.com/document/d/1ql6li6Au6ccO-xoTpQRM_ilF5Z6FMeGtbRGGi7BOD4Q/edit?usp=sharing))
- Intro to Perusall (https://www.youtube.com/watch?v=M8bOP7yF_6I) (Perusall Introduction Video Transcript) (https://docs.google.com/document/d/1OPT_i7YrembK3518QiKaYcgCIgsM-BRbuCCc7Y-BQXU/edit?usp=sharing)