**Background**

Scientific Papers are the primary way that scientists communicate their findings to other scientists and the general public; Scientists can essentially be thought of as “professional writers” since papers are the main tangible product of their research. Keeping up with the literature is the best way to stay current in a given fields and many labs hold “journal clubs” where they will read and discuss a paper together, usually on a weekly basis. In the Friesen lab, every lab member takes turns picking a paper and guiding discussion about it; you should expect to do this once a semester.

What follows is a brief guide to the types of Scientific papers available in the literature, a guide to reading a paper in preparation for lab meeting, and an outline for guiding paper discussion in a lab meeting.

***Remember: Reading and discussing papers should be, and usually is, a lot of fun!***

**Types of Scientific Papers**

Most papers can either be classified as “Methods Papers,” “Data papers” “Meta-analyses,” “Review Papers,” or some combination of these categories – I’ll define these below but all of them could be appropriate for lab meeting discussions:

Methods papers – These papers give a detailed description of a new method that other scientists may want to apply to their own research. These papers are extremely useful to read if you’d like to learn about a certain method but can be difficult to discuss in a lab meeting. It may be better to pick a “data paper” that uses that method you’re interested to answer a scientific question for the purposes of lab meeting discussion.

Data Papers – these papers present the findings of experiments or observational studies (Results of computer simulations could be included in this category as well); when we’re doing research in the lab or field its usually because we’d like to write it up in a data paper. They’ll have a format very much like a lab report in a science class with sections labeled “Introduction, methods, results, discussion.” These papers are most of what is produced by Scientific Labs and are great to discuss in Lab Meeting for a variety of reasons.

Meta-analyses – As the name implies, these papers summarize the data from many studies in a certain area of research to try to look at the “big picture.” These are written much like “data papers” but the methods section will focus heavily on statistical analysis.

Review papers – Much like “meta analyses” these papers are also focused on the “big picture” but they typically summarize the findings of a particular field in a qualitative (rather than quantitative) sense. Good review papers provide a unique perspective on a field and identify holes in our knowledge, rather than simply summarizing results of other studies. The format of these changes from journal to journal. These can make for great discussion.

**How to Read a Scientific Paper in Preparation for Lab Meeting**

Do the following: print the paper out; read every word; look up words you don’t know; scribble down comments/definitions in the margins of the paper; highlight/underline as necessary; bring this copy with you to lab meeting. Note that a lot of papers now include “supplemental online material” which you may want to read as well (definitely do this if you are guiding discussion)

Also, Identify the following things (these mostly apply to data papers, but some of these things can be identified in good meta-analyses and review papers as well). Sometimes these things are not explicitly stated in a paper but you should be able to identify them nonetheless:

Research question(s): What were the authors trying to figure out about the natural world? Why did they do this experiment in the first place?

*example: Do plants need light to grow?*

Hypothesis: This is essentially a hypothetical answer to the above research question, which explicitly points out mechanism and should include the word “because.”

*example: Plants need light to grow because light powers photosynthesis, the process by which plants create biomass from CO2*

Predictions: These are testable statements in the form “if \_\_\_\_ , then \_\_\_\_” that derive from the hypothesis.

*example: if plants are deprived of light, then they will not grow; if plants have access to light, then they will grow*

Independent variable(s): the “explanatory” variable; the one that that is manipulated in an experiment. These can be categorical or continuous (examples below)

*example: light*

*categorical example: light, no light;*

*continuous example: 0% normal sunlight, 10% normal sunlight, 20% normal sunlight….100% normal sunlight)*

dependent variable(s): the “response” variable; the one that is measured in an experiment

*example: plant growth*

other specifics on methods: how did they set up the study, measure the things they wanted to measure, and analyze the data?

*example: 10 plants pre treatment, all incubated at 20 deg. C, growth measured by change in biomass, results analyzed by linear regression, etc.*

results/discussion: Were the predictions correct? Was the hypothesis supported or unsupported?

In addition to all this stuff, come ready to discuss things “beyond” the paper. Take a second to come up with and answer some discussion questions about the paper (examples below):

*What are the logical next steps of this research?*

*Could the study design be improved?*

*How can we apply these results to other systems?*

*How does this shed light on things we’ve learned from other studies?*

*How is this useful to your research (or the interests of the Friesen lab)?*

**How to Guide Paper Discussion at Lab Meeting**

Searching for papers – You can search for papers online; note that we are looking for peer-reviewed scientific journal articles rather than those from popular publications (*i.e.* *Nature* rather than *National Geographic*). A very useful online search tool is “Web of Science” which should be accessed through the MSU library website under “Electronic Resources.” You will have to enter your MSU ID and password to access the search engine but once you do so, you should be able to get PDFs of papers you find for free using either the “Find text @ MSU” of “Find Text from Publisher” buttons beneath each search result (most journals charge for access, but MSU subscribes to these journals and your MSU ID allows you to access their content for free).

The “Web of Science” search engine works very much like Google (though pay attention to the drop down menu next to the search box and the “range of years” at the bottom of the search page); note that you can also look at papers that cite, or are cited by, a certain paper from the results page (which is a good way to “follow a research trail”). It’s also a good idea to click on a result and skim the abstract before going through the trouble to get the PDF – the title alone doesn’t always give you enough information to figure out whether a paper is worth reading.

Picking the best paper to present – Pick a paper that is relevant to your own research but that also may be interesting to other people in the lab. From a “keeping up with the literature” standpoint its also nice if the paper is fairly new (published within the last ~5 years) and no one in the lab has read it before; of course, picking “classic” studies we have not yet discussed is sometimes appropriate as well. There’s nothing wrong with picking shorter papers (such as those from *Nature, Science,* and *PNAS,* which are also high impact journals) as these will be a quick read for others in the room but don’t shy away from picking longer papers if you’d really like to discuss them. Avoid picking a paper just because you think it’s a “bad” paper; while “bad” papers provide plenty of fodder for discussion, a lab meeting full of criticism and ridicule is often not that useful; that time would likely have been better spent discussing a “good” paper.

Sending a paper out for discussion. Once you’d picked a paper, send an email to the Friesen lab listserve with a PDF of the paper attached; try to do this SEVERAL DAYS in advance of the lab meeting so that people have time to read the paper (*example: if lab meeting is on Thursday, send out the paper on Monday*). In the text of that email, you should explain why you picked that paper and what kind of discussion you’d like to have about it. Important: READ THE PAPER BEFORE YOU SEND IT OUT (or at least skim it); reading the title or even abstract alone doesn’t always let you know a paper is going to be good for discussion and once you’ve sent it out you’ve committed to discussing that paper.

Guiding Discussion – Read the paper thoroughly and prepare a Powerpoint presentation that centers around the figures/tables/other results from the paper as you see fit. However, remember that you are not giving a presentation about the paper; the Powerpoint allows us to look at the figures we are discussing together rather than all staring at our individual printouts the whole time. You should not be talking the whole time but rather participating in discussion and asking questions of the group when necessary to guide discussion as you see fit. Ideally discussion will go “beyond the paper” and it helps to come up with a list of questions/topics you’d like to cover (though hopefully everyone in the room should participate in this process as well, which is why examples are listed in the “how to read a paper” section of this document). Discussion will generally last ~45 min -1 hr. (*Its never a bad idea to bring snacks to share!*)