HOW TO SUCCESSFULLY READ A SCIENTIFIC PAPER:

Here are things to keep in mind when reading papers, regardless of exactly what your goal is. We are all learning how to read the scientific literature, and we can always improve. By keeping these tips and suggestions in mind whenever reading a paper, you will be more able to actively participate in class discussions, and to lead them when it is your turn to be the "local expert" on a topic.

Each paper will have two students assigned to be "local experts" on each of the following topics to streamline our discussions:

1. *Context and Basic Science*
2. *Experimental Techniques*
3. *Regulations and Comparison of Methods*

While our discussions will only go well with all students asking questions about all aspects, any "unassigned" students in the class will have the role of actively questioning the "local experts" and moving the discussion along.

General:

- *Read each paper in detail*. Be prepared to ask questions and venture opinions. It is more fun to discuss the issues with the local expert than to listen to the local expert present.
- *Prepare handouts and/or presentations*: Think about the best way to present your information to your classmates. Are there tables of data, or diagrams? Type or draw them up onto handouts and pass them out. This will help you organize your thoughts and help your classmates understand your presentations. **Prepare at least one handout per presentation.**
- *Ask questions:* When you are reading, **write down** a list of questions about all aspects of the paper, including the topics that you are not presenting. This will be collected. These questions can be on the level of "what does this mean" referring to a specific portion of the paper (not just a definition, though), or can be "how does this type of instrument work," or a variety of other options. They should address details as well as general issues.
- *Present details:* Go in depth! Tell us everything you can about your topic. Details details details! It's the only way to understand what the authors are doing.
- *Look in reference books:* You will find lots of information, figures, details, etc. that you might want to know. How does a GC/MS work? What is a carbamate?
- *Include references:* Tell us where you found your information! It's good (required!) academic practice, and it will be helpful for others who need to look for similar kinds of information in the future.
- *Talk to Deborah and others for resources and planning advice:* I am happy to help you decide what aspects of the paper fall in your responsibility area, where to find resources (books, people, etc.), and ways to present things.
- *Pose questions as well as presenting details:* Are there big issues you read about that you want to discuss? Bring them along!
- *Put it all together:* As we make our way through each paper, try to put things together. See how learning about the regulation makes it clearer why the researchers did what they did, for example. Bring up these connections that you see in class!

Context and Basic Science:

- *Step back from the details to provide context.* Think about why the authors did the research they are presenting. If the paper is about detection of pesticides in water, tell us why people care. Are there health effects or environmental effects? How big a problem is this? Where is it a problem?
- *Provide a glossary of terms*: What words do we need to know that we might not already? The "basic science" role is perfect for this. Highlight every word in the paper that you don't know, look it up, and provide everyone with the definitions. Chances are if you don't know it, the rest of us don't either.

- *Check in with the "experimental details" people*: If you're not sure, check in with the people presenting the details of the experimental measurement, and divide up who will present what. In many cases, the basic science people will have enough to present without going into the details of the experiments. A good division might be for the basic-science person to tell us what the instrument being used is, how it works, how sensitive it is, etc., and for the experimental methods people to describe how this instrument was used by these researchers, including sampling, sample prep, *etc*.
- *Don't be afraid of equations*: If the paper includes equations describing the analysis or something about the sample, show us where they come from and what they mean. Omit nothing. Derive, look up, and explain as much as you can. Ask for help if you want it.
- *Define topics to discuss rather than only present*: You can take two approaches to your presentations (probably more, actually), either presenting material or trying to discuss it. The latter is more fun. Think of things you can get your classmates to think about. What questions can you pose to them to get everyone involved?

Experimental Methods:

- *Figures and diagrams are critical*. Provide a block-diagram (i.e. boxes and arrows) of each instrument you describe, and a flow-chart of the experimental procedure if it is helpful. Often you will need to refer to references in the papers we read to find schematics of instruments and details of experimental procedures. Put those figures on handouts and bring them to us.
- *Give us some information about the use of the method*: Are other people using this too? Is it standard or did the authors of the paper just invent it? You can often determine this based on references in the paper. Do Sci-Finder or Web of Knowledge (Web of Science) searches to find out, too.
- *Details details details*: Where better to provide a lot of technical details than in the experimental section? What do they mean by a PUF filter? What kind of laser are they using, and why did they choose that one? What are the units that the results are presented in, and how can we think about them?

Regulations and Comparison of Methods:

- *Handouts*. There is a lot of detail in the regulations. Prepare a handout to help us sort it all out. Give us examples of the types of things regulated by the regulations you refer to, and the goals. Do these regulations fall under a larger act (such as Clean Air Act) that we need to understand also? If so, give us information about this!
- *Use the GPO web site to see figures and appendices for the CFR's*: The Congressional Universe for some reason often omits the details, such as figures and appendices which present details. Try other methods for getting the same information, especially the GPO website given on the syllabus. It provides complete copies of the regulations.
- *Summarize the approved method*: Same as above, give us block diagrams, details of the sample preparation, sensitivity, *etc*., that the required methods utilize. What are the parameters that the method defines? While we don't need details such as "measure out 25 mL of sulfuric acid into…" we do need to know what is involved in the method. What are the interferences, problems, difficulties with the method? Why would the researchers who wrote the paper we're reading want a new method? Compare the two!