Scientific Reading

STEM GATEWAY UNM

Essential Academic Skills Enhancement

Workshop Series

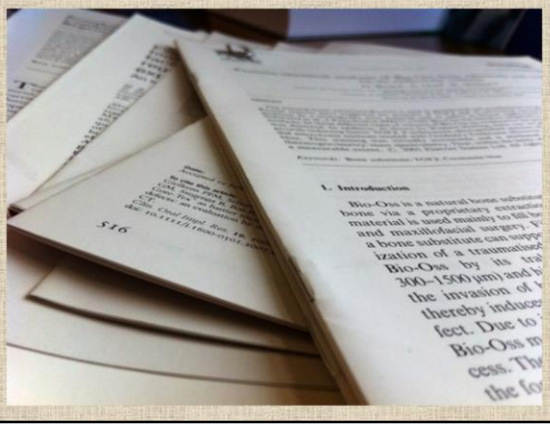
http://goo.gl/lcha0y

Welcome to the EASE workshop series, part of the STEM Gateway program. This power point will also be available on the this site, so you can always refer back to it at a later time if necessary.

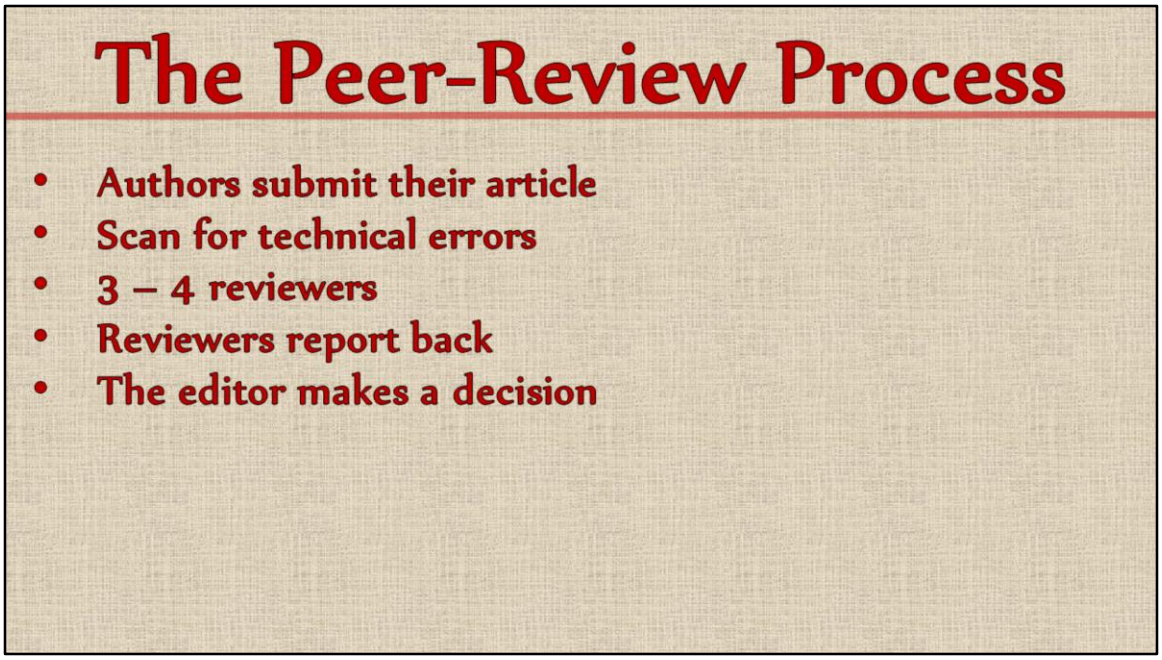
At the end of the workshop, you'll have to complete a Survey before you are dismissed. The URL and QR code are here, and also on your assessment sheet if you are able to do them electronically, which would be greatly appreciated. You'll just keep the confirmation page up and show it to me as you hand in your assessment sheet. If for some reason you are not able to do it electronically, I can give you a paper version at the end of the presentation.

Scientific Articles

- Presents research results
- Written by researchers
- Academic readership
- Peer-reviewed



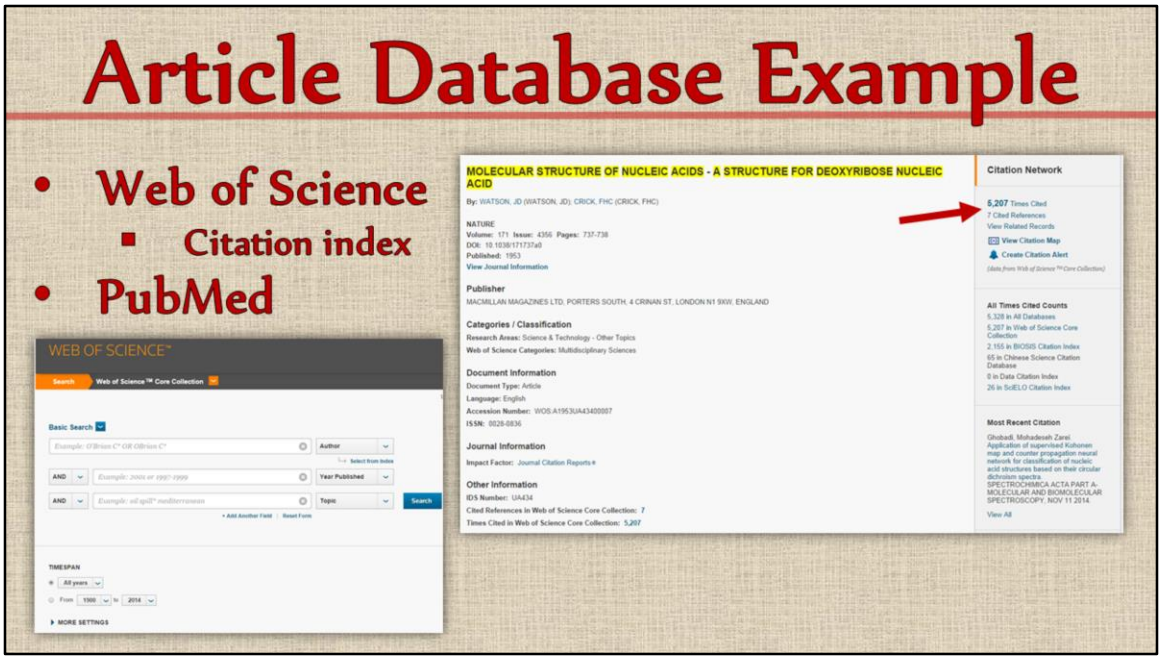
Before we can get too far into scientific reading and writing, we need to first establish what a scientific article is.
(*) It presents research results, either first hand, or in a review format. Which we'll discuss a bit more on that in a few minutes.
(*) Scientific articles are written by scholars or researchers
(*) Is aimed at an academic readership, meaning it is technically written
(*) And must go through the peer-review process.



Here is the basic peer-review process. Once you have written up your manuscript, you submit it to a journal of your choice, one that fits well with your research and the angle you took with your paper.
(*) the journal editor scans it for technical errors, and
(*) then sends it out to 3 – 4 reviewers within your field of study.
(*) they report back to the editor with their comments and suggestions for publication, including a focus on the quality of the research, any inaccuracies, etc.
(*) The editor then decides if the paper should be published. Responses from the editor include: accepted, accepted with minor changes, accepted with major revisions, rejected but encouraged to re-submit, or rejected. Reasons for straight up rejections are usually flaws in the research or inappropriateness of the study for the chosen journal.

But, keep in mind that just because it's printed does not guarantee it's valid; the peer-review process helps eliminate blatant issues, but the knowledge base of the reviewers and the technology or understanding of a topic at a particular time play a roll.

To quickly refresh your memories on what you learned last semester in your library research strategies workshop, sources of scientific information are:
(*) The physical library
(*) Web searches, either through a Google type search, or through an article database search
(*) Reliable scientific journals
(*) Reference lists from articles you've already read
(*) The popular press, like magazines, etc, but be careful with this one and make sure to look at the original source
(*) And the often overlooked, personal network.



A benefit of using an article database is that you can move forward and backwards in time, so you can see which citations a paper has, or who has cited that paper. You can also save these references to EndNoteWeb (which is FREE to UNM students), which has a cite-while-you-type plugin.

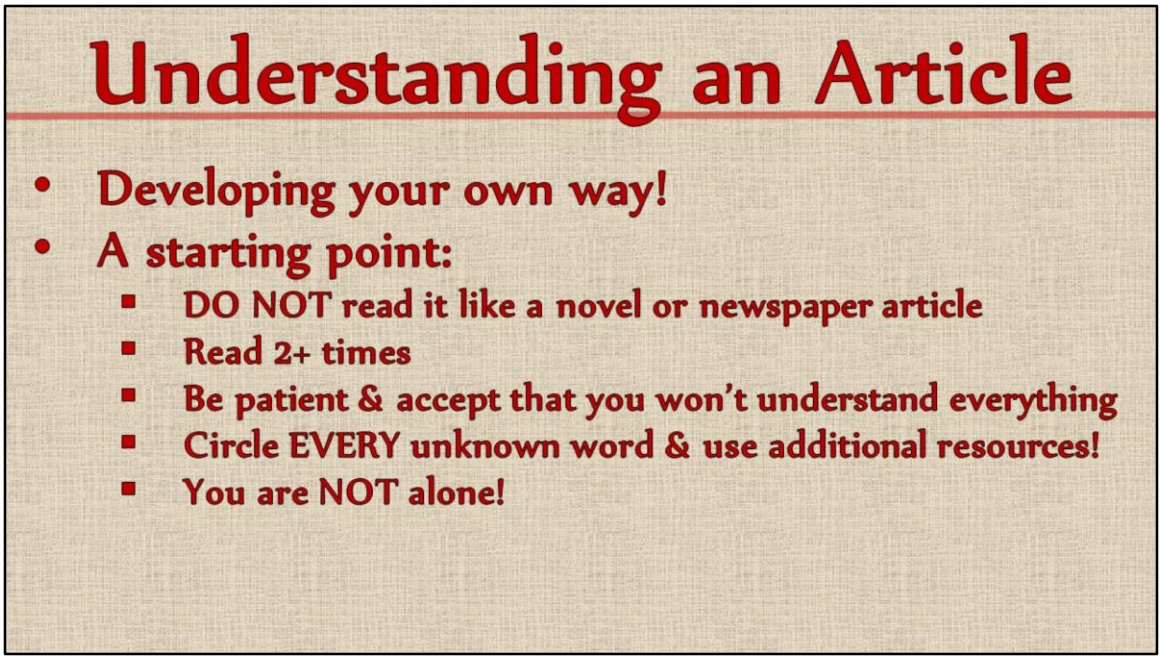
Work Cited

- See our Scientific Writing presentation for more details on this.

Anatomy of a Manuscript

- Abstract
- Introduction
- Materials & Methods
- Results
- Discussion/Conclusion
- References/Literature Cited/Bibliography

To quickly refresh your memory of the general structure of primary research article. The order of the many topics depends on the article. There are also sometimes supplementary information that is available online.
(*) The abstract is a summary of the paper, that includes the why, how, and what of the research.
(*) the Introduction contains background information about the topic, sets the stage for the questions addressed by the authors, and the main questions asked.
(*) the Methods are usually very technical and details HOW the study was conducted.
(*) the Results are the “meat” of the article. The data from the methods, including figures and tables. Generally, the data are stated but not interpreted at this point.
(*) the Discussion/Conclusion are the authors interpretation of the results and what questions remain un-answered.
(*) and lastly, the references provide enough information of cited works to allow you to find the original paper.



Whether your goal is just to gain information for fun, find background articles for your own writing, or writing your own paper, the following methods on how to understand an article are important. The more you read, the easier it will be to write, since you will become more familiar with the style. (*) also, don't be afraid to develop your own way! What we'll go over now is just a starting point to help you get started, but is by no means the only way or an all inclusive way.

(*) So, to start off, make sure you are not trying to read the article like a novel or newspaper. There is way too much information and it is much too dense for this. You can focus on which aspects of the article you are interested in, since you can have different reasons for reading each article. You may also have to go back and forth within the article while you're reading it.

(*) Be ready to read the article at least 2 times, probably more

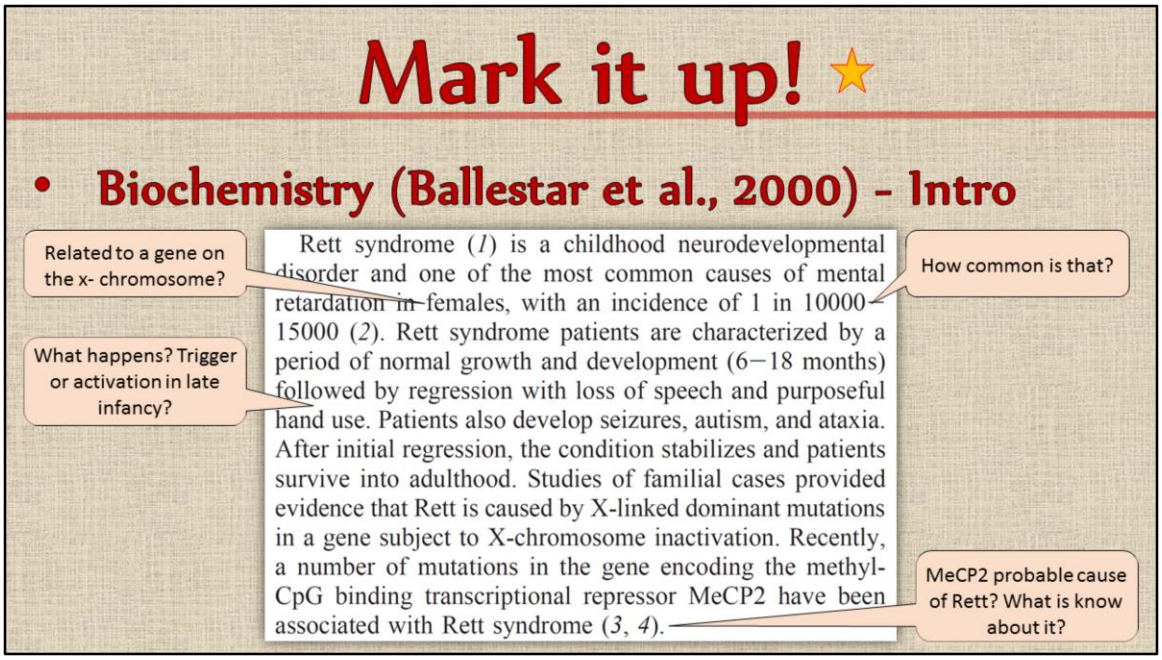
(*) Remember to be patient with yourself. It takes time to become comfortable reading scientific papers. Also, like everything in life, the more you practice, the better you will become. Tied into this is that you'll come across WAY more papers than you would ever have time to read, so it's ok to be choosey, at least at first. Accept that you won't understand everything. Nobody understands everything they read in an article. This is because you don't have the necessary background (i.e. various approaches or topics are beyond your knowledge.), it's too complicated, or it

doesn’t make sense.
(*) Make sure to circle the words you don’t know so you can go back and look them up before you read the article for the second time, to help you fully understand the paper and it is ok to use other resources to help increase your understanding, these can include textbooks, the internet, dictionaries, your network.
(*) Also, you are not alone. Most people often feel “lost” or “substandard” when reading manuscripts. I still feel that way when I discuss them with my lab mates.

At all phases

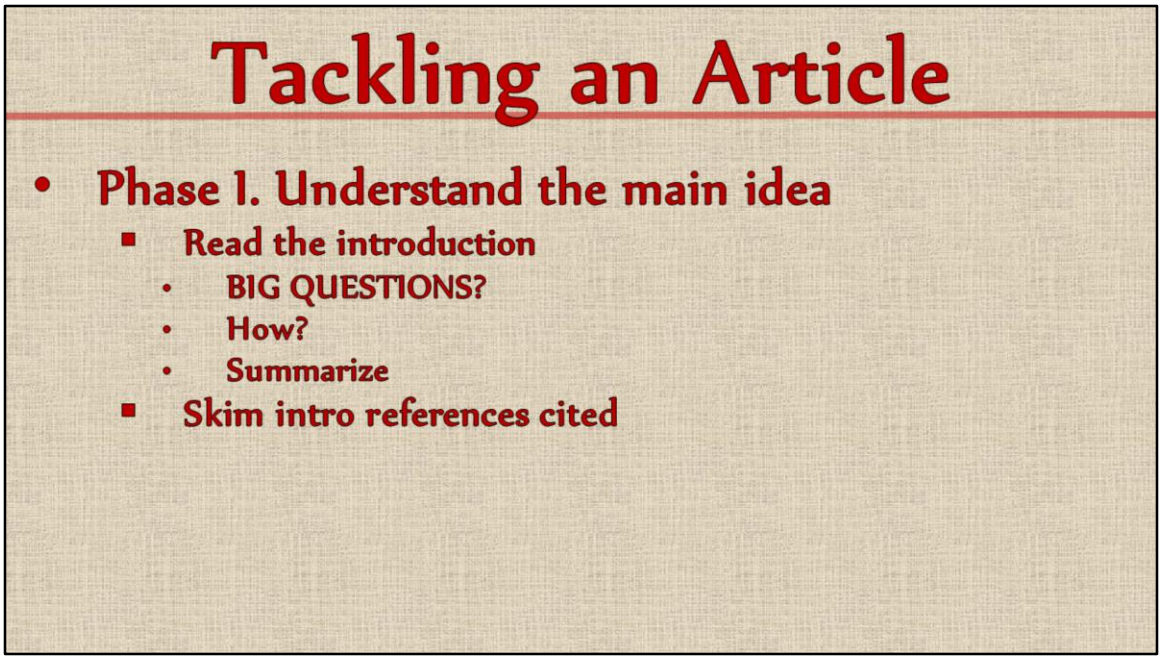
- **Mark it up!**

As you read through the paper, along all phases, highlight, question, thoughts, notes, and more! Look up unknown words or concepts. A great quote that applies to reading articles is “Be skeptical. But when you get proof, accept proof.” – Michael Specter. It is the authors job to convince you that their question, methods and conclusions are sound.



Let's practice how you could mark it up. I want you to read this paragraph, and as you do, what questions come to mind? Discuss with your neighbor and w**rite these down on your assessment paper.**

What did you come up with? (discuss). Great, and some others are
(*) (go through them). And many more!
Remember, you can highlight major points, react to the points that they make, construct your own examples, summarize what you read, etc.



Keep in mind, many of the aspects of tackling reading an article can directly translate into writing an article. It's all about having a plan of attack. You can also use this approach to reflect if you have written in such a way that hits all of these main points.
(*) Start off by reading the introduction. This is the easiest part and gives good background information. It also puts the current research into perspective.
(*) As you read it, ask yourself not "what is the paper about", but "what problem(s) are the researchers addressing?" This helps you focus your thoughts as you read the rest of the paper.
(*) And, HOW? – What approach are they using to answer these questions?
(*) When you are done, summarize the background in 5 sentences or less. This helps you understand why this research is being done, thus increases your understanding as you read the rest of the paper. A way to do this is to ask yourself: What work has set the foundation for the authors to address the BIG QUESTION? How does their work fit into this? How do they propose to address the question?
(*) Then, go back and skim the references cited in the intro, especially those that are connected to points that are of interest to you. This can help you find additional articles or main points to cite in your own paper.

Tackling an Article

- **Phase II. Understand the approach**
  - **Figures and tables**
  - **Beginning and end of the discussion**

The next phase is to understand HOW they did their study, at least in a general sense.
(*) Start by looking at the figures and tables. Even if you don't understand them right away, it will help when you read about them in the paper.
(*) Then, read only the beginning and ending of the discussion. The first and last few paragraphs get to the quick and dirty of the actual research.

Tackling an Article

- **Phase III. First read-through**
  - Skim Intro
  - Skim the Methods
  - Read the Results*
  - Read the Discussion (in full)*
  - Study the figures and tables
  - Read the Abstract LAST

* (more on this in a minute)

The third phase is when you actually read through the entire article.
(*) start by refreshing your memory on the introduction.
(*) Next you only need to skim the methods, make sure to identify the basic methods, and only spend a lot of time on parts of this that are relevant to how you might approach your own research.
(*) Read the results, which we'll discuss on in minute,
(*) then the entire discussion.
(*) Go back through the figures and tables now that you've read the main article.
(*) Finish by reading the abstract. Do this last so that you are not biased while reading the paper, it makes it easier to question their clarity, approach, interpretation and conclusion. Think of it this way. Who's seen the movie "Inception"? When the idea is implanted in your mind, you may think the conclusions are yours, but they are really being driven by that implanted though, that's the same here. Do not let the authors interpretation influence your thought process. As you read it, ask yourself if what it says matches what you thought? This is also a good way to see what they felt were the main points you should have taken away and guide you in your second round of reading.

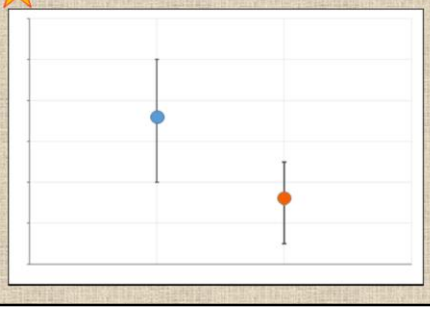
Tackling an Article

- **Phase IV. Increase your understanding**
  - **Re-read the entire article**
  - **Use the reference list**
  - **End by re-reading the abstract**

The last phase will help increase your understanding of the article.
(*) Re-read it at least once more, possibly more, if necessary.
(*) Look through the references for two reasons. 1) you can check or follow-up points made in the paper, and 2) gain a deeper understanding of a cited concept, or related papers.
(*) End by re-reading the abstract.

Interpreting Results

- As you read the results
  - Summarize: results, figures, and tables
  - "Significant" and "non-significant"
  - Standard deviations and error bars ★
  - Sample sizes



Alright, when it comes to interpreting the results of a paper try to
(*) Summarize them. Don't try to decide what they MEAN, just what they ARE. This includes the captions!
(*) Pay close attention to the use of "significant" and "non-significant". That means there should be statistical support for these conclusions.
(*) Related to this are the error bars or standard deviations on their graphs or values. Is that important? Discuss this with your neighbor. **Write reasons down on your assessment paper.**
(*) What did you come up with for reasons? (discuss) So, let's visualize this a bit. If you have these 2 points on a graph, would you say they are different? Probably. But now, what if I added error bars (which could represent Standard Deviations), would you still say they are different? No, because there is an overlap in range of values within the data set.
(*) Also pay attention to the sample sizes. Are they sufficient for answering their question or drawing conclusions?

Interpreting Results

- Do the results answer the specific questions?
- What do YOU think the results mean?

Each result should go to lend support for the main question(s) of the paper. Are the questions answered?
(*) What do YOU think the results mean? You may change you mind as you read the authors interpretation in the discussion, but it's good to try to formulate your own conclusions as best you can before reading what they concluded.

Interpreting Results

- What do you think this means?

New England Journal of Medicine (Nichol et al., 1995)

Table 3. Health-Related Benefits Associated with Vaccination.*

Study Outcome	Rate per 100 Subjects		Difference (95% CI)	Vaccine Effectiveness	P Value
	Placebo Group	Vaccine Group		%	
Primary					
Episodes of upper respiratory illness	140	105	35 (17–53)	25	<0.001
Days of sick leave due to upper respiratory illness	122	70	52 (21–84)	43	0.001
Visits to physicians' offices for upper respiratory illness	55	31	24 (8–40)	44	0.004
Secondary					
Days of upper respiratory illness	974	780	194 (15–373)	20	0.034
Days of sick leave due to all illnesses	203	129	74 (23–125)	36	0.004

*The values are mean cumulative totals for the four-month period from December 1, 1994, through March 31, 1995 (the influenza season). CI denotes confidence interval. Vaccine effectiveness was calculated as the difference in the rates of outcome variables (placebo group − vaccine group) divided by the rate in the placebo group, multiplied by 100.

Let's practice. Looking at this table, what can you say about it? What is the standard deviation? Was the sample size sufficient? What do you think this means? Discuss with your neighbor and write your thoughts on your assignment paper.

What did you come up with? (Some points are: tables and figures should be able to stand alone, without needing to reference the body of the text. So, this table is providing information about effectiveness of vaccines. We can see that all of the results are statistically significant between the two groups, vaccinated and placebo, as indicated by the p-value.)

Interpreting Results

- Summarize the figure
- What do you think this means?

Nature (Walther et al., 2002)

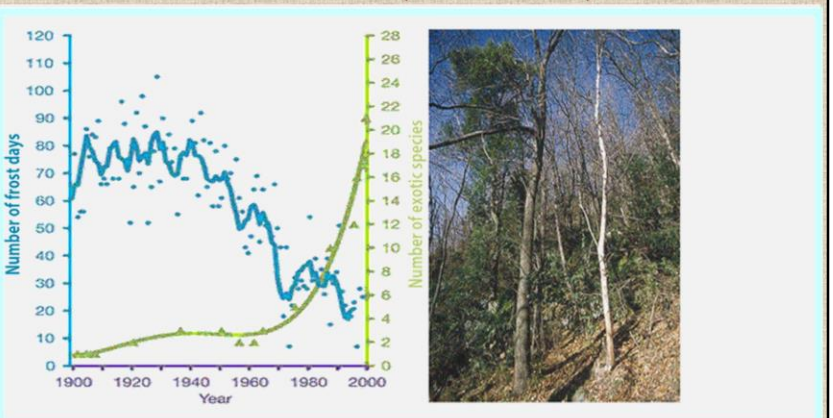
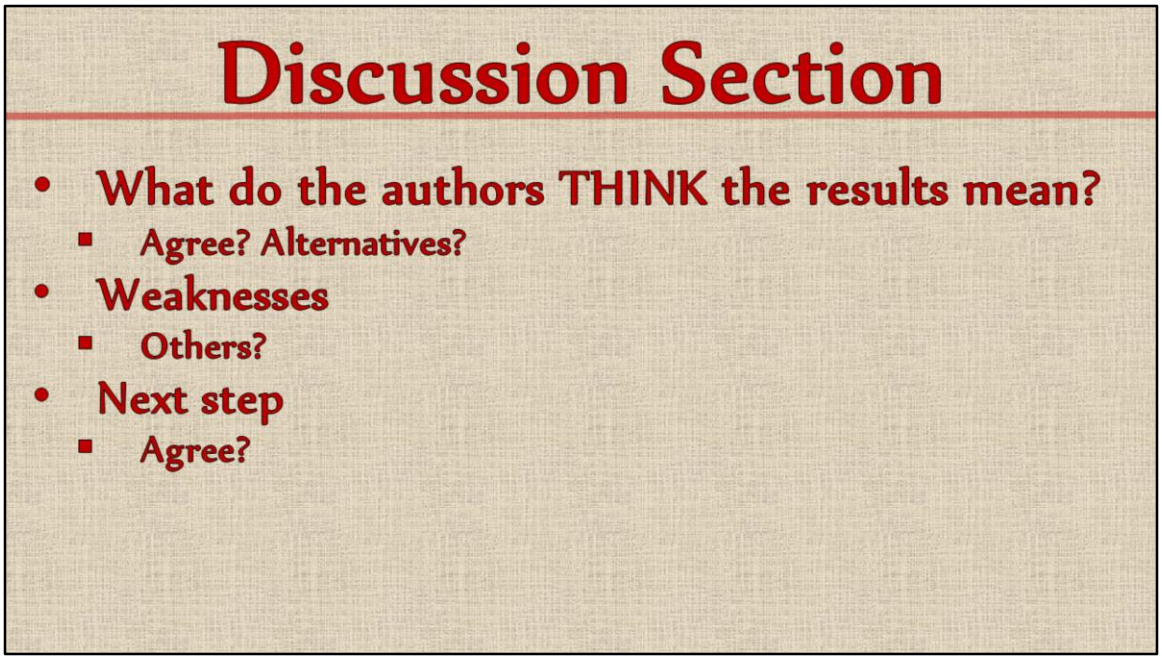


Figure 3 Vegetation shift from indigenous deciduous to exotic evergreen broad-leaved vegetation in southern Switzerland. The shrub layer is dominated by the growing number of spreading exotic evergreen broad-leaved species (see illustration) that appear to profit from milder winter conditions, indicated here by the decreasing number of days with frost per year (the smoothed curve gives five year averages for the number of frost days per year)[29].

Ok, let's try one more. What did you come up with? (some points can be: as the number of frost days decrease the number of exotic species increases. You can look at the scatter of the plot, are there any outliers?)

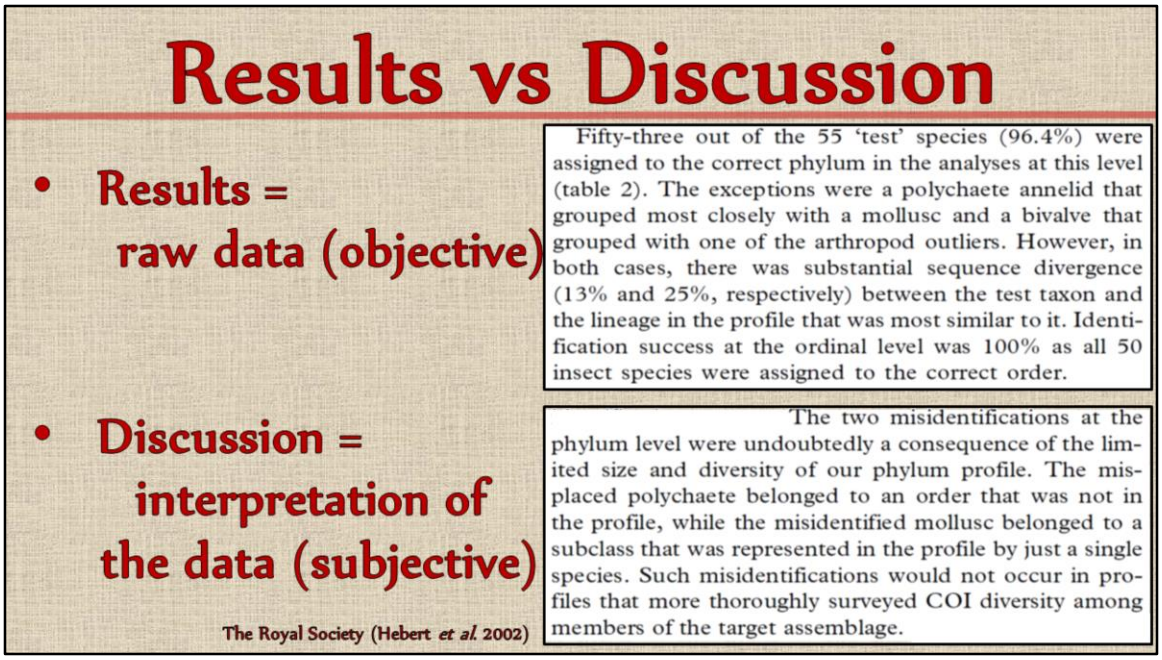


When reading the discussion, keep in mind that it is what the authors THINK the results mean. Science is a learning process and we never know anything with 100% certainty, but we can see what is highly supported.

(*) As you read it, ask yourself if you agree with their interpretation and see if you came up with alternative reasons for their results.

(*) It's important to address your weakness or limitations head on. Did the authors do this? Did you catch any weaknesses in their study?

(*) Lastly, since science is ever changing, there is always a next step. What did the authors say theirs was? Do you agree? Can you think of anything else?



To be able to move from reading a paper into writing your own, the distinction between the results and discussion sections is important. I really want to emphasize the difference between the two. Again, the results are the raw data presented in a completely objective fashion. While the discussion is the authors interpretation of the results, so there may be a slightly subjective slant.

(*) For example, this statement (read) from the results does not attempt to EXPLAIN the results, but rather, just states what they are.
(*) It is here in the discussion that points to the interpretation.

Are there any questions?

Remember, this power point is available on the EASE workshop portion of our site,

Now, please take a minute to complete the survey. When you are done, show me the confirmation page and turn in your assessment and you are free to go.

If you can not do it electronically, please raise your hand so I can give you a paper version. You'll hand that in with your assessment.