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.

What is a Scientific Article? ⭐

- **Presents research results**
- **Written by researchers**
- **Academic readership**
- **Peer-reviewed**
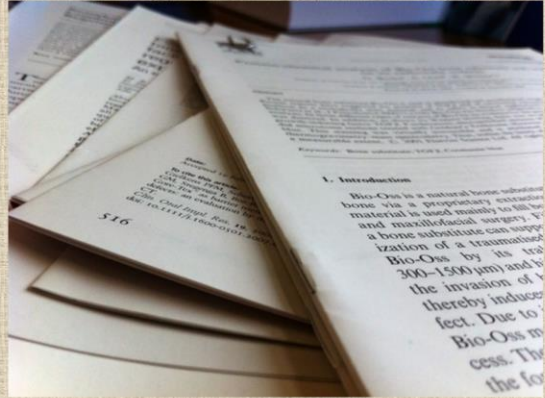
Before we can get too far into scientific reading and writing, we need to first establish what a scientific article is. So, what do you think? What are some characteristics of all scientific articles? **Write these down on your assessment paper.**

(*) Well, first 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.

The Peer-Review Process

- Authors submit their article
- Scan for technical errors
- 3 – 4 reviewers
- Reviewers report back
- The editor makes a decision

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.

Sources of Scientific Info

- Library
- Web searches
  - Basic web
  - Article database
- Reliable journals (Primary & Review articles)
- Reference lists
- Popular press
- Personal network

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

- Format is journal specific

- Cite-while you type plug-ins
  - For example: EndNote, which is tied to Web of Knowledge (myendnoteweb.com)

ENDNOTE® basic

My References   Collect   Organize   **Format**   Options   Connect^Beta

Bibliography | Cite While You Write™ Plug-In | Format Paper | Export References |

Bibliography   [Cite While You Write™ Plug-In]
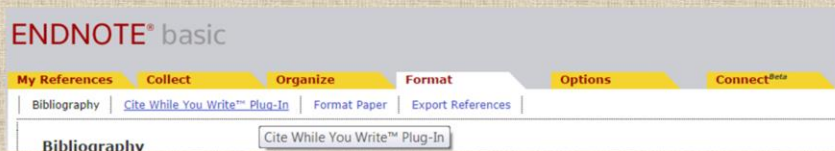
That means, if you add or remove citations in the body of your paper, you don't have to constantly be re-checking your citations and formatting, because it does it for you. You do have to remember that the format of your literature cited depends on the journal (or class requirements), so double check you have this right. Cite-while-you-type plug-ins are very helpful, but you still need to check the format. An example as to why.

When you search literature in Web of Knowledge, you can save it to Myendnoteweb.com. But, there are MANY format options, and, often the entry itself is off, italics may be missing, the title could be in all caps, or a number of issues. So, when you use this auto feature, then it takes these errors with it.

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.

Understanding an Article

- Developing your own way!
- A starting point:
  - DO NOT read it like a novel or newspaper article
  - Read 2+ times
  - Accept that you won't understand everything
  - Use additional resources!

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

(*) 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.

(*) That said, it is ok to use other resources to help increase your understanding, these can include textbooks, the internet, dictionaries, your network.

Remember

- Be patient and don't conquer everything
- You are NOT alone!
- Circle EVERY unknown word

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.
(*) 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.
(*) 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.

Tackling an Article

- ## Phase 1. Understand the main idea
  - ### Read the introduction
    - BIG QUESTIONS?
    - Summarize
  - ### Skim intro references cited

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.
(*) 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 11. 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
    - Identify SPECIFIC QUESTION(S)
    - And the HOW?
  - ### 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.

(*) Make sure you know the SPECIFIC QUESTIONS – what exactly are the authors trying to answer?

(*) And, HOW? – What approach are they using to answer these questions?

(*) 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
  - Mark it up!
  - 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.

(*) 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.

(*) 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.

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 **write 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.

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? ⭐

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.)

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Interpreting Results

Nature (Walther et al., 2002)

- **Summarize the figure**

- **What do you think this means?**
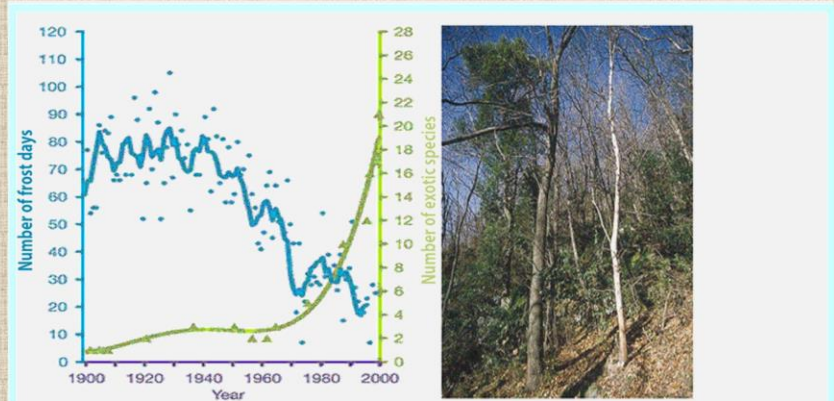
Figure 3 Vegetation shift from indigenous deciduous to exotic evergreen broad-leaved vegetation in southern Switzerland. The shrub layer is dominated by the growing number of spreading exotic evergreen broad-leaved species (see illustration) that appear to profit from milder winter conditions, indicated 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?)

Discussion Section

- **What do the authors THINK the results mean?**
  - Agree? Alternatives?
- **Weaknesses**
  - Others?
- **Next step**
  - Agree?

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?

Results vs Discussion

- **Results = raw data (objective)**

- **Discussion = interpretation of the data (subjective)**

The Royal Society (Hebert *et al.* 2002)

Fifty-three out of the 55 'test' species (96.4%) were assigned to the correct phylum in the analyses at this level (table 2). The exceptions were a polychaete annelid that grouped most closely with a mollusc and a bivalve that grouped with one of the arthropod outliers. However, in both cases, there was substantial sequence divergence (13% and 25%, respectively) between the test taxon and the lineage in the profile that was most similar to it. Identification success at the ordinal level was 100% as all 50 insect species were assigned to the correct order.

The two misidentifications at the phylum level were undoubtedly a consequence of the limited size and diversity of our phylum profile. The misplaced polychaete belonged to an order that was not in the profile, while the misidentified mollusc belonged to a subclass that was represented in the profile by just a single species. Such misidentifications would not occur in profiles that more thoroughly surveyed COI diversity among members of the target assemblage.

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.

Writing Your Own Paper

- CAPS writing center
- Use the steps to reading
- One section at a time
- Do your background research!

The first thing I want to mention when it comes to writing your own paper is that CAPS has a writing center that is FREE for you to use and get help with any of your writing.

(*) The steps to reading translate into writing because the people who will read your paper are taking the same approach, so you need to make sure each section is clear and concise.

(*) Just as with reading, you'll want to focus on one section at a time.

(*) It is very important to do enough background reading to set a foundation for your paper.

Writing Your Own Paper

- No fluff!
  - Especially with Materials & Methods
  - Topic sentence with content support
- Write in:
  - 1st person active voice
  - past tense (except results)

(*) One thing that is difficult to do is make sure there is no fluff. That means that every word is important. This is hard because in our English classes we've been trained to elaborate, use extensive descriptions, and paint a picture for the reader. The structure of each paragraph should be such that the first sentence sets the stage for the rest of the paragraph.

(*) Use active first person in the past tense. That means, speak as if all the work was already completed (which it should be at this point), and get to the point. Say "I threw the ball", rather than "the ball was thrown by me". The exception to this is the results, which are written in the present tense because they are what they are, even now.

Writing Your Own Paper

- Outline, then introduction
- Abstract and Title LAST
- Figures and tables – clear and stand alone
- Citations
- Edit, edit, edit, and PROOFREAD

The best place to start is with an outline, which should include bullet points that you aim to address within each sub header. Once you have a good picture of the content of the entire paper, then start with the introduction.

(*) Do the abstract and title last so that you make sure they accurately reflect the points you made in your paper.

(*) Make sure that your figures and tables are clear and can stand alone from the text.

(*) Double check your citations, including formatting even if you use a cite-while-you-type, and make sure your figure/table numbers match the order they appear in the text.

(*) Lastly, I can't say this enough, EDIT AND PROOFREAD your paper and make sure to have others do the same, at various stages of the paper. Getting another persons perspective is great for both content and grammar and we all have different styles and backgrounds, so it helps weed out any issues the text may have.

Do any of you have any proofreading tricks that you use? (discuss). Some others are reading the paper out load, and read each sentence forwards then backwards then forwards – this helps find repeat words, missing words, or improper use of words.

You want to make sure the paper is as clean as possible so that the reader can focus on the content of the paper rather than becoming confused as a result of poor writing style.

Common Problems ★

Many studies have examined the differences between many groups of eusocial animals. It is without contention, that H. glaber is better than AHBs. Evolution designed naked moles rats to lack pain receptors (see Figure 3) (LaVinka and Park 2012), which proves they are better suited for their environment, however, that is not the only factor in our decision. This data lead me to look at the mechanics behind the increased deaths surrounding AHB (Figure 1; O'Malley and Nalen 2009).

To go over some of the common problems that appear in your own writing, take a minute to discuss with your neighbor which issues you see in this paragraph. Write them down on your assessment sheet.

What did you find?
(*) The use of between, rather than among
(*) Lack of italics for Latin names/words
(*) No citation for such a bold statement
(*) Spell out abbreviations the first time you use them
(*) Assigning intent when it is not appropriate. Evaluation is a process, thus it can't design.
(*) You don't need to say SEE, it is implied
(*) Combine neighboring parenthesis with a ;, like down here (point out at the end of the paragraph)
(*) Prove should only be used if a mathematical proof, the word support, or something like that is better
(*) However and Therefore should have a ; or . before it, otherwise it's a very long run-on sentence
(*) Data is plural, thus is should read, THESE data

(*) Don't switch between I vs We
(*) Figures should be labeled in the order they appear

Common Problems

- Use of:
  - That/which
  - Affect/effect
  - Its/it's
  - Choose/chose
  - Advice/advise
  - Accept/except
  - Proceed/precede
  - Less/fewer
  - Further/farther
  - Who/whom (people only)

Some other words that are often mixed up are (read)

Common Problems

- Clichés and overused expressions
- Verbal variety!
- Singular vs. plural
  - Species
  - Genus vs. genera

The last few problems we'll go over are to
(*) Try to avoid clichés or overused expressions because people are tired of them, and it shows a lack of creativity.
(*) don't be redundant. For example, don't start each sentence off with "I".
(*) And, in addition to "Data", some tricky verbiage that trips people up are the difference between singular and plural forms are (read)

Laboratory Notebook

- Keep better records than you think you'll need
- Write down EVERY step in detail
- Stay organized

A few last points before we wrap things up. First is the use of a lab notebook. This is one of the most important things you can do in scientific research is keep excellent records of everything you do, from the actual experiment to the data analysis.

(*) If you are not sure, write it down! Sometimes there is a lag between runs and it's easiest to just refer back to notes, rather than re-learning each step.

(*) The more organized you are, the easier all of this will be, especially when you are working with other people.

Working with Others ⭐

- Determine roles
- Establish a goal and the BIG QUESTIONS
- Methods
- Speak up
- 3x longer than you THINK it will take

The last thing that is often a challenge is working with others. This is an inherent issue in STEM research. What do you think are some potential challenges? **Write these down on your assessment paper.**

The first step you should take is determine what role each person should take. Have somebody take lead, others in charge of doing the experiment, another taking notes or recording results, somebody to run the analysis, create figures/graphs, and you can also break up the writing into sections. Every person should edit the paper.

(*) Make sure you are all clear on the BIG QUESTION you are trying to address, what are your goals?

(*) How will you attain these goals? What is the best approach? Are there more than one?

(*) Speak up! If you disagree with something, whether it's the question, the approach, the interpretation, the roles, anything, it's important to say so, but do so in a tactful manner. If somebody isn't carrying their wait, let them know and work out a solution.

(*) Lastly, everything always takes longer than you think it should. Take the amount of time you think something will take and triple it. That's how much time you should really plan for. It's always better to have extra time than not enough. This is a good rule of thumb for most things in life.

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.