

MSWI PRESENTS

A McGill Guide to  
*Scientific  
Writing*

VOLUME I

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# Chapter 1: Introduction

Welcome to the MSWI Scientific Writing Guide! This booklet aims to act as a guide for McGill students learning to write, read, or present scientific material.

Scientific writing is not merely writing about science. It is a technical method that scientists use to effectively convey their findings within the academic community and beyond. It is based on scientific inquiry and, therefore, requires precision and clarity. Learning to communicate science through writing is a necessary skill for courses and careers alike. Chemistry and biology courses require thorough lab reports, and a career in science requires project proposals, analysis, and publication of manuscripts.

In addition to scientific writing, reading scientific material is a meticulous process that requires an understanding of the subtleties of the experimental method and research article structure. In this guide, we will review the structure

of research articles and propose tips to help you best annotate and understand paper findings. Learning to read scientific material is a valuable asset to have as both a researcher and student.

If you cannot clearly, concisely, and logically present your project, it does not matter how ground-breaking your research is. Therefore, clearly articulating your work is a vital asset as a scientist.

To summarize, the objective of scientific writing is to correctly communicate your findings and work. The following chapters are written to help you best meet this objective.

As you browse our booklet, remember:

***“You’re not writing to impress. You’re writing to communicate.”***

P.S. Be on the lookout for this symbol  as it indicates a hyperlink!



## Chapter 2: Types of Scientific Material

**Lab Reports** - Lab reports are an essential part of science education and are good practice for writing research articles. Lab reports are used to assess whether you have completed and understood the content of the lab experiment. Consult [Chapter 4](#) to read a more in-depth guide to lab reports at McGill.

**Research Articles** - Research articles are primary sources that report the methods and results of an original study. The study could be an experiment, survey, or interview, but, in any case, raw data is collected and analyzed. Research articles are typically published in a peer-reviewed journal, meaning other scientists review it to ensure its accuracy and quality. See [Chapter 5](#) on the structure of research articles for more information.

**Review Articles** - Review articles (or literature reviews) are secondary sources that include a collection of data

from existing research. They do not include original research. Review articles are essential because they summarize concepts and suggest new research directions. Many assignments in university require you to create or consult review articles, and, therefore, it is vital to understand how to retrieve reliable and accurate scientific data. See **Chapter 6** for more information about finding such sources.

**Case Studies** - Case studies are typically intensive investigations about a person or group, which aim to generalize to a broader demographic. Usually, case studies occur in natural settings and examine in-depth data relating to several variables. For example, a doctor may write a case study on the diagnosis and treatment of one patient to generalize the findings to a larger cohort with similar presentations.

**News Articles** - News articles are vital to communicating scientific findings to the general population. Many popular media sources such as National Geographic, The

Guardian, The New York Times, and The Washington Post have a dedicated science section.

**Posters Presentations** - Poster presentations are an effective way to communicate research, share ideas, and promote discussions with other scientists. Presentations focus on the primary points of your research rather than specific details. Posters are typically presented at conferences and symposiums, and serve as a visual summary of your research.

# Chapter 3: Vocabulary and Writing Tips

## Vocabulary

Using effective vocabulary in scientific writing is essential to properly conveying your message. The following words are commonly used in scientific writing and presentations.

Verbs	Nouns	Adjectives	Transitions
<ul style="list-style-type: none"> <li>• Assess</li> <li>• Attribute</li> <li>• Clarify</li> <li>• Contemplate</li> <li>• Convey</li> <li>• Corroborate</li> <li>• Deduce</li> <li>• Demonstrate</li> <li>• Disprove</li> <li>• Dispute</li> <li>• Emphasize</li> <li>• Establish</li> <li>• Evaluate</li> <li>• Extrapolate</li> <li>• Hypothesize</li> <li>• Identify</li> <li>• Illustrate</li> <li>• Influence</li> <li>• Invalidate</li> <li>• Investigate</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis</li> <li>• Context</li> <li>• Criterion</li> <li>• Demography</li> <li>• Derivation</li> <li>• Distribution</li> <li>• Evidence</li> <li>• Incidence</li> <li>• Interpretation</li> <li>• Mechanism</li> <li>• Occurrence</li> <li>• Parameter</li> <li>• Prevalence</li> <li>• Procedure</li> <li>• Process</li> <li>• Proportion</li> <li>• Scope</li> <li>• Speculation</li> <li>• Validity</li> <li>• Variable</li> </ul>	<ul style="list-style-type: none"> <li>• Abnormal</li> <li>• Apparent</li> <li>• Causal</li> <li>• Conceptual</li> <li>• Considerable</li> <li>• Constitutive</li> <li>• Critical</li> <li>• Discrete</li> <li>• Distinct</li> <li>• Equivalent</li> <li>• Impactful</li> <li>• Indicative</li> <li>• Justifiable</li> <li>• Methodical</li> <li>• Predominant</li> <li>• Responsive</li> <li>• Selective</li> <li>• Significant</li> <li>• Strategic</li> <li>• Technical</li> </ul>	<ul style="list-style-type: none"> <li>• Approximately</li> <li>• Comparatively</li> <li>• Consequently</li> <li>• Conversely</li> <li>• Evidently</li> <li>• Explicitly</li> <li>• Furthermore</li> <li>• Hence</li> <li>• However</li> <li>• Initially</li> <li>• Likewise</li> <li>• Moreover</li> <li>• Nonetheless</li> <li>• Regarding</li> <li>• Significantly</li> <li>• Similarly</li> <li>• Specifically</li> <li>• Therefore</li> <li>• Thus</li> <li>• Ultimately</li> </ul>

In modern scientific writing, it is critical to use descriptive action verbs that can more precisely capture what you are trying to say. Replace generic words with more apt vocabulary to better convey your message and add uniqueness to your writing.

## Active and Passive Voice

In the active voice, the subject of the sentence performs the action. In a sentence written in the passive voice, the subject receives the action.

*Active: Research demonstrates that high stress can cause heart attacks.*

*Passive: It was demonstrated that heart attacks can be caused by high stress.*

Evaluating the usage of the word 'by' in sentences is an easy way to check for passive voice (e.g. "...caused by...").

In scientific writing, try to use the active voice whenever possible. However, in the case of the methodology section or descriptions of lab activities, passive voice is typically preferred. For more information about active and passive voice, please read the following resources by [Ashford University](#) and [University of Toronto](#).

## Organization and Structure

Create an outline before you start writing. An organized outline with varying levels of ideas makes the writing process much simpler and more efficient.

Make sure your writing flows in a logical order. To do this, use headings and subheadings to separate and organize discrete sections of your writing. Maintaining a logical order helps the reader to optimally understand your writing. This is known as readability.

Every paragraph should have one topic sentence. All sentences in a paragraph should support, describe, or elaborate upon what the topic sentence is about. This structure helps with readability. After you write a paragraph or sentence, think to yourself: Why am I placing this information here? Could it fit better elsewhere?

## Other Essential Writing Tips

- o Ask: "Will this make sense to the reader?" Keep in mind who your audience is and remember your goal is to

communicate with others, not yourself. To help with this, get someone who is not an expert in your field to read over your writing to ensure high readability.

- o Do not assume your audience will interpret information in the same way you do. Not everyone has the same scientific background so it is important to explain anything that is not common scientific knowledge.

- o Use effective transitions between sentences, subsections, and paragraphs. Think logically about where paragraphs should begin and end.

- o Give yourself enough time to write several drafts. After you have written a section, leave it alone for a few days, and return to your writing with fresh eyes. This will help you view your writing from a more objective perspective.

- o Actively seek out opportunities to read different scientific texts, whether that is through reading more articles or offering to edit a friend's paper. More exposure to scientific writing will help improve your own writing skills.

# Chapter 4: Lab Reports

## Preparing for Lab Reports

The best way to prepare for a lab report is to make sure you understand the lab in its entirety. To do this, read your lab manual thoroughly before the lab, and avoid cramming!

### Ask yourself these questions:

- What are we doing in this lab? ✓
- Why are we doing it that way? ✓
- What are we hoping to learn from this experiment? ✓
- How does this relate to course content? ✓

Answering these questions will lead you to a more complete understanding of the experiment, and this "big picture" will, in turn, help you write a successful lab report. Depending on what type of learner you are, you can either write these questions down or say them aloud to commit them to memory.



If you have any questions about the procedure (before or during the experiment), ask your TA. After all, they are there to help you. Once you have completed these steps as you perform the experiment, you will be in a good position to draft a quality lab report.

## **General Lab Report Guidelines**

*Courtesy of Catalina Dumut, Teaching Assistant at McGill University*

**Title** - The title should encompass the entirety of the lab. It should be as descriptive as possible but in as few words as possible. Lastly, modern science prefers strong action verbs in the title, as it attracts more attention.

**Abstract** - Provide a brief summary of the lab report. Include the purpose, short recap of the theory and methods behind the lab, significant findings, and conclusions.

**Purpose** - State the experimental objective and the techniques used.

**Introduction** - Clearly state a hypothesis. Give background information on the experiment. Why are you performing

the experiment? What is the logic behind it? How does the set-up work? Describe the processes involved (cellular process, chemical reactions, etc.), while making sure to cite multiple sources.


**Results** - Outline all findings and observations obtained. Remember you are only describing results not interpreting them. If you want to mention something in your discussion, it must first be outlined in the results section. It is important to include all observations even if it was not what was expected! You can analyze discrepancies later in the discussion.

**Discussion** - Briefly summarize your results. Always compare results to controls and standards. Talk about how the results differ from what was expected. Notably, you should cite sources other than human error to explain any variations from the expected results. Write about modifications and improvements that can be made should the experiment be repeated. Discuss the importance of the results in relation to the objective of the lab and the original hypothesis.

**Appendix** - Figure titles/descriptions go below the figure. See **Chapter 7** for tips on how to make effective figures and tables.


## Writing Lab Reports

### Significant Figures

[Here](#) is an in-depth explanation of significant figures with examples and solutions. 

### Quantitative vs. Qualitative Data

- *Quantitative data* is composed of numerical values and can be expressed in numbers (e.g. frequency, temperature, etc.).
- *Qualitative data* is composed of descriptive observations that cannot be numerically represented (e.g. visual appearance, blood type, etc.)

 MSWI has also created a separate resource for McGill-specific lab reports. Click [here](#) to download it. 

# Chapter 5: Structure of a Research Article

Writing, reading, and analyzing research articles is not an innate skill. Scientific writing follows a specific format, and practice is required to master that format. This chapter summarizes the structure of scientific research articles to prepare you to write, read, and analyze similar articles during your time as a student and scientist.

## Writing and Reading Scientific Research Articles: a Review

McGill Scientific Writing Initiative (1)

1 - McGill University Faculty of Science

### Title

The title of your paper should be both **attention-grabbing and informative**. To keep it short, avoid phrases such as "study of" or "analysis of." The title should indicate what you are studying (e.g. method, variables), but does not have to include everything. Use active verbs to engage readers. Avoid abbreviations.

Consider the following four questions when constructing your title:

1. What is the main subject of your research?
2. What method are you using?
3. Which population are you studying?
4. What are your key outcome measures or results?

It can help to answer these questions in two to three brief sentences, remove any unnecessary words, and then rearrange what remains to create a cohesive title.



## Abstract

The abstract is a **200-300 word summary** of all of the main components of a research article. Most people will use the abstract to decide whether they want to read the entirety of your paper, so be sure to include critical details and findings. While it is formatted to be placed at the top of the research article, it is easier to write after you have completed your paper's body so you can easily summarize each section in one or two sentences.

## Keywords

Keywords affect the searchability of the paper and are usually placed after the abstract. An easy way to determine keywords is to choose the **most essential nouns** in your abstract. Examples of keywords for this writing guide would be *scientific communication*, *undergraduate*, and *research*.

## Introduction

An introduction acts as a **brief literature review** to offer background knowledge. This allows the reader to better understand the context, content, and significance of your research. Recall, the reader will often not be an expert in this field of study. Keep the introduction concise and focus on the specifics that you address in your research question. There are four main questions to address in an introduction:

1. What is the societal, scientific, environmental, or economic significance?
2. What is the current state of literature in this field of study?
3. What are the current gaps in knowledge?

4. What is your objective and hypothesis?

A concluding statement should summarize the purpose of the study and the hypothesis.

## Methodology

The methods section is not simply a numerical list of steps, but, rather, a **clear and detailed description of your experimental procedure**.

Readers should be able to replicate your experiment just by reading this section.

You should use an active voice in the section (see Chapter 3). Include a description of the (1) independent variable(s) and how they were manipulated and (2) dependent variable(s) and how they were measured.



Sometimes, you may choose to justify why a particular technique was used, but you can include this in the discussion section instead.

Provide a summary of your data analysis methodology (e.g. what statistical program you used) but do not draw any conclusions from the data at this point.

### Results

The results section **describes all the outcomes of data analysis**, including statistically non-significant findings. Similarly to the methodology section, you do not make any inferences yet. Drawing conclusions, referencing the original hypothesis, and examining the significance of the results are reserved for the discussion section only. However, it is important to remember anything you wish to discuss in the discussion section must be first introduced in the results section.

### Discussion

In the discussion, **interpret the results and theorize their significance**. Here are some questions to ask yourself:

1. What do the results suggest?
2. Do the results support your

hypothesis? Why or why not?

3. Were your findings unique or similar to previous research?
4. What does your research add to the existing body of knowledge in this field?

Be sure to always specify when you are speculating rather than stating a fact. Use words such as “possibly,” “perhaps,” and “suggests” rather than “proves.” You should also discuss the limitations of your study, how they may have impacted your results, and potential ways to overcome these limitations in future research.

Brainstorm potential new directions of research based on your findings. For a science student, the discussion is the most crucial section of a research article. Pay close attention to this section while reading a scientific paper.

### Conclusion

The conclusion is a short paragraph that **summarizes the entire research article** from introduction to discussion. No new information is included at this point. However, you may choose to discuss potential future directions and suggest next steps.

## Other components

**Authorship** is rewarded for significant contributions to the development, execution, and analysis of the research study and the writing of the manuscript. The order of listed authors varies for different fields, but in general, the first author is the individual who has contributed the most, and the last author is the supervising figure (e.g. thesis supervisor).

**Acknowledgements** are reserved for individuals who do not meet the authorship requirements but still contributed to the study. This may include laboratory technicians or supporting clinicians.

**Funding** received and potential conflicts of interest should be disclosed.

**Ethics** approval should be explicitly stated.

If you wish to learn more about writing, reading, or annotating research articles, keep an eye on MSWI's [events calendar](#) or [subscribe to our newsletter](#) to stay updated about upcoming events and workshops. ➤

# Chapter 6: Where to Find Scientific Data

## General Guidelines

When looking for scientific data, make sure your sources are credible. Some great places to start your search are:

- Academic libraries, journals, and databases (e.g. Nature Physics, PLOS, PubMed)
- Government databases
- If you are still unsure, reach out to the McGill Library staff!

## McGill Library Resources

### Subject Guides



- Databases are organized by subject with detailed instructions on how to access full articles.
- It is best to access these databases through the McGill library website since you will already be logged in and granted permission.



- Using the [McGill VPN](#) allows you to access the majority of journals even when you are off-campus. ➤
- There are also links to different [course guides](#) with more relevant databases. ➤

### [Health Sciences Research Basics](#)

 ➤

- Health sciences research basics guide
- Excellent starting point to guide your research

### [Find Articles Resource](#)

 ➤

- Resource to find articles based on a specific topic
- Helpful for finding specific articles as well

### [Maps and Geospatial Data](#)

 ➤

- Collection of maps, air photos, and atlases

### [Subject Guides for Engineering and Physical Sciences](#)

 ➤

- Useful for finding books, articles, and other subject-specific materials

*Whenever possible, it is important to be mindful of representing different populations of work when searching for scientific data. The scientific community continues to evolve in diversity, and it is our responsibility to reflect this in our writing.*

# Chapter 7: Tables and Figures

## General Tips

When glancing through a paper, the figures and tables are often what people stop to read in detail before reading the main text. A figure or table should be able to stand alone without any supporting text, so it is important to make it as descriptive as possible. While the primary purpose is to be informative, figures should also be visually appealing and easy to read. Figures and tables are numbered based on their order of appearance within the paper, but you can also choose to include some of them as supplemental data instead of in the main text.

Microsoft Excel, Adobe Illustrator, and ChemDraw are common tools used by students to create figures and tables.

Be sure to familiarize yourself with the submission guidelines, whether you are writing for a course professor or a specific journal. Oftentimes, there are unique formatting requirements and limitations to the number of figures and tables allowed.

## Tables

Tables can be used to present the demographics of the study population or to summarize results of data analysis. Be sure to have subheadings to organize information, adequate spacing between cells, and a legible font size. Do not leave out important information, such as units, and remember to define any abbreviations you use.

## Figures

Figures serve to visualize experimental set-up and showcase primary data. Keep in mind the potential for bias when choosing which type of figure to use. If you have a blurry image, consider presenting the information in the form of a digital schematic instead. Using colour intelligently within your figures can help clarify concepts, but remember using colour does not replace the use of legends or labels. Keep in mind some journals have restrictions for colour usage or require an additional fee for colour printing. For further guidance and software suggestions for making effective figures, check out the paper ["Ten Simple Rules for Better Figures."](#)



# Chapter 8: Citations, Plagiarism and Source Diversity

## Plagiarism

McGill defines **plagiarism** as the “*representation of another’s work as one’s own or assisting another in representing another’s work, published, or unpublished, as their own*” (McGill, 2020). The penalties for proven cases of plagiarism are severe and include: Conduct Probation, course failure, and a notation on permanent record, which can affect future graduate school applications. Consequently, it is crucial to understand what is considered to be plagiarism and to take active measures to avoid it.

**Collusion** - although it is often useful to brainstorm with peers, avoid extensively collaborating on individual assignments.

**Submitting work that is not your own** - do not use websites where you can pay to have an assignment problem solved for you.

**Completing someone else's work** - peer editing can be a powerful tool, but avoid physically changing the work. Instead, provide suggestions or edits in the form of comments and questions.

**Self-plagiarism** – do not simultaneously submit the same academic work to two journals or resubmit a published paper to another journal (or class unless explicitly stated otherwise). If you want to include an idea from a previous paper of yours, you must cite yourself and your co-authors.


**Missing or improper citations** – diligently keep track of all sources you use (even during preliminary research) and use the required citation style. Certain programs can help you stay organized by integrating citations as you write.

## **Citations**

Citations provide the necessary information needed to find the original source that you referenced while writing your academic work. The benefits of citations are three-

fold: (1) They allow for accountability in scientific research, (2) They acknowledge other scientists' contributions, and (3) They create a thread of knowledge that researchers can use to find related scientific material.

As you conduct research, try to write ideas in your own words and record the source (link or DOI #). You should cite everything except for common knowledge (e.g. “There are 13 provinces and territories in Canada.”). If another researcher’s work inspired any part of your experiment, including methodology, you must acknowledge it. It is always better to over-cite than under-cite. Understanding that in-line citations can make a paper feel cluttered, we recommend trying different formats (e.g. In 2018, James et. al. suggested...).

Citations can be quite complex, with each style consisting of many structural components. Between references, works cited, bibliographies, and footnotes, it is easy to get overwhelmed. Here is a resource that goes over the different types of references (e.g. in-line citations, footnotes) in more detail: [Purdue General Formatting](#). 


## Citation Resources


There are thousands of different citation styles that exist, many of which are unique to specific academic journals or scientific fields. Common styles you might encounter are **APA** for social sciences and education, **MLA** for humanities, **Chicago** for sciences, and **Vancouver** for medicine. This may seem overwhelming, but the good news is professors or journals will usually specify which citation style they require. You can find McGill librarians that specialize in specific citation styles [here](#). Also, there are many online programs to help you easily generate citations. It is important, however, to check these online programs, as they are not foolproof!

**EndNote** is a citation software available free of charge to all McGill students. Although the initial learning curve can be steep, there are online tutorials and McGill library resources to help navigate it. Once you know the basics, creating proper citations will be quick and stress-free.

*Always ask for help when you are unsure! Not citing or citing incorrectly can lead to losing easy marks and disciplinary action.*

## Diversity of Sources

A key indicator of research quality is the diversity of consulted sources. It is helpful to reference a wide variety of sources to gain a holistic and representative understanding of a topic. One useful tool is [ProQuest](#), a database that allows cross-searching curated collections of scholarly journals, dissertations, eBooks, etc. 

Moreover, the lack of diversity in research is not limited to source types. Many groups are underrepresented in research, both as research participants and scientists. This includes women, ethnic minorities, people with disabilities, and socially disadvantaged populations. This has serious ethical consequences and can undermine the integrity of research. It is imperative to be aware of this issue and correct for it in your own research by actively seeking diverse perspectives and creating equal opportunities for all qualified individuals. A platform for finding underrepresented scientists is [Diverse Sources](#). Although  it was created for journalists seeking scientific expertise, it is a valuable resource for science students as well.



## Chapter 9: More Resources

**MSWI Events** - Aside from this writing guide, MSWI also hosts a variety of workshops on scientific communication, with topics ranging from presentation skills to annotating research articles. View [our website](#) for more information. ➤

**McGill Scientific Communication Classes** - A more detailed summary of courses that focus on effective scientific writing can be found on our [Resources page](#) or the McGill eCalendar. ➤

**The Writing Centre** - The McGill Writing Centre is located in McLennan-Redpath library. This service is McGill's primary resource for written communication. It provides writing support via tutors and specialized writing courses. Tutors provide guidance in organizing ideas, making persuasive arguments, and eliminating grammar errors. However, they do not specialize in scientific writing, so keep that in mind! Book a tutoring session [here](#). ➤

 *Covid-19 update: The Writing Centre is offering online sessions until they are able to resume in-person sessions.*

**Additional Online Resources** - Many specific resources were mentioned in earlier chapters of this guide, including EndNote and ChemDraw. Here are two more general resources to help improve your writing:

### *Grammarly*

Grammarly is a digital writing tool that uses artificial intelligence and natural language processing to improve writing. The free version completes basic grammar checks. The premium version is a paid upgrade that offers over 400 features. Some of our favourite Grammarly premium features are active/passive voice detection, formality level, and inclusive language generator!

### *WordCounter*

WordCounter is an online editor that improves word choice and writing style. Additionally, it helps you to detect grammar mistakes and plagiarism. This program counts words and characters, identifies overused words, determines the reading level of your text, and estimated speaking time.

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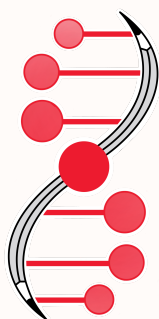
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