

# EDUCATION

## Effective Scientific Writing in English

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In this world of complex and non-standardized scientific terminology, manuscript preparation for submission to an English language international scientific journal can be challenging for non-native English speakers. It is critical to develop a concise composition style, while maintaining a sufficient level of scientific background for reader orientation. This seminar highlights specific aspects of effective scientific writing in preparation for journal submission, from appearance and organization to rules on repetition, and also it includes points for English science learning.

### Effective scientific writing for journal submission

The first step to achieve a well-written manuscript is to determine the intended audience and fully envision what the audience will need to comprehend your study. Then, to strive towards reader-based text, you must define and understand the following qualities of good writing: accuracy (正確性), clarity (明確性), completeness (完全性) and economy (無駄のなさ). To achieve accuracy, it is important to employ correct and precise language to express both facts and thoughts. For clarity, all sentences should have only one meaning. In a manuscript written with clarity, the reader will not become distracted by excessive words and ideas; rather, they will be able to focus on one important point per sentence. To apply the quality of completeness, it is imperative to include all of the information necessary for the

reader to understand not only the background, but also the reason the study was undertaken, the results, practical applications, limitations and conclusion. By providing a complete comprehensive manuscript, you allow the reader to evaluate the study topic. The final quality, economy, relates to the efficient and concise use of English, which means the following: 1) using only the necessary words within a sentence, and 2) avoiding excessive repetition. Complex ideas do not require complex language. Scientific writing should be easy and even enjoyable to read! For the quality of economy, when writing, you must ask yourself, “Is this sentence easy to understand? Is this sentence enjoyable and interesting to read”? By carefully considering these four qualities, you will be able to write text written specifically to meet the needs of the reader.

The next step towards achieving a well-written manuscript is to shorten phrases. Shortening goes hand in hand with the above quality, economy. The following Figures 1-4 describe various means of shortening and provide examples of eliminating negatives. Bear in mind that although you are striving towards shortening the text, that does not mean that contractions can be used (Fig. 3). The reason is that contractions are not considered appropriate for formal speech or literary language; they are to be used for informal conversation.

It is important to consider how each individual sentence can have impact. By removing “There

### Shortening ideas

<u>Wordy version</u>	→	<u>Short version</u>
. A majority of	→	most
. A number of	→	many
. Are of the same opinion	→	agree
. Less frequently occurring	→	rare
. All three of the	→	the three
. Give rise to	→	cause
. Due to the fact that	→	because
. Have an effect on	→	affect

Fig. 1. Examples of shortened phrases

### Shortening Methods

- ◆ Eliminate negatives  
否定語を用いない。
- ◆ Eliminate excessive uses of “there are/there is”  
“there are/there is”を多用しない。
- ◆ Eliminate needless prepositions  
必要のない前置詞を省略する。

Fig. 2. Three ways to shorten text

### Eliminate negatives

. Not honest	→	dishonest
. Not harmful	→	safe
. Not important	→	unimportant
. Does not have	→	lacks
. Did not remember	→	forgot
. Did not pay attention to	→	ignored
. Did not succeed	→	failed

Fig. 3. Examples of eliminating negatives

is” and “There are” at the beginning of a sentence, not only do you shorten the sentence, but also you create a more impactful meaning. For example:

There is an association between cancer and smoking. → Smoking is associated with cancer.

One means to achieve impact is to use the active voice (能動態), rather than the passive voice (受動態). By structuring sentences with subject • verb • object [主語 + 動詞 + 目的語], rather than

### Avoid contractions, such as:

<u>Avoid</u>	→	<u>Use</u>
. it's	→	it is
. weren't	→	were not
. didn't	→	did not
. haven't	→	have not
. can't	→	cannot

Fig. 4. Ways to avoid contractions

### Experiment with punctuation

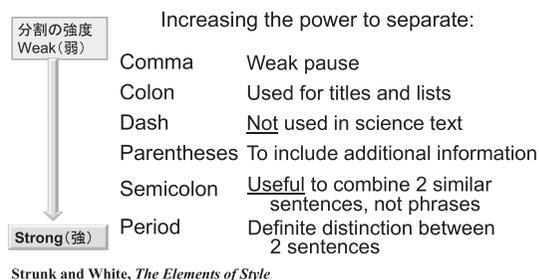


Fig. 5. Various forms of punctuation

object • verb • subject [目的語 + 動詞 + 主語] we can improve clarity and impact. For example:

A recommendation was made by the doctor to lower salt intake. →

The doctor recommended to lower salt intake.

Another means to achieve both shortening and impact is through the use of punctuation. Start by experimenting with different types of punctuation to determine the most fitting type for each specific sentence in your text. As outlined in Fig. 5 (modified version from *The Elements of Style* by Strunk and White), the various forms of punctuation have different powers of separation. There is a large difference in separation power between a colon and semicolon. The colon, although relatively weak, has an important status in the realm of punctuation in that it can be useful in titles and lists (Fig. 6). In contrast, the semicolon is more powerful; it can be used to join two sentences of

## Colon

Use in a title and in lists

- ❖ **Title:**
  - Type 2 diabetes; principles of pathogenesis and therapy.
- ❖ **Procedure:**
  - From a dietary standpoint, there are two approaches: (a) weight loss to enhance insulin sensitivity, and (b) changes in the nutrient content of diets.
- ❖ **List:**
  - These responses occur in four steps: desensitization to insulin action, leptin secretion, inflammation, and, finally, a counter-inflammatory phase that conserves energy storage.

Fig. 6. Examples of ways to use a colon

similar meaning. The reason the semicolon is so useful is because it can be employed to “shorten” a very lengthy sentence, by dividing it into two easy to understand smaller sentences, rendering the reading to be concise; each shorter connected sentence can have more impact.

Another way to improve clarity and achieve impact is by using parallel sentence construction. Parallel structure refers to the repetition of the same pattern of words or phrases within a sentence. Not only the structure forms should match, but also the tense should match. Using parallel structure makes it easier to understand the sentence and also adds value to the overall composition. Note the following example:

*Non-parallel:* We aimed for a blood glucose decrease and improvement in hypertension.

*Parallel:* We aimed to decrease blood glucose and to improve hypertension.

Another step towards effective scientific writing is consideration of the manuscript appearance, which is directly related to the paragraph size. Short paragraphs make a paper appear choppy. It is recommended that a paragraph be no shorter than three sentences. In contrast, if a paragraph is too long, it is likely to cause the

reader to lose interest. Paragraphs should have one topic and should start with a topic sentence. The final sentence should be a transition sentence to the subsequent paragraph or a concluding sentence. Although the organization of scientific papers is simple when following the “IMRAD” layout (Introduction, Methods, Results and Discussion), section balance must be considered. For example, the appearance of a paper will look unbalanced if the Results section is four pages and the Discussion section is only one-half page. An overly lengthy Results section is generally due to excessive repetition, which is superfluous and tiring for the reader. In the Results section, it is recommended to write a summary comment about each figure and table, together with the accompanying (figure/table) citation; note that listing each result datum within the text body is not necessary and leads to tedious redundancy.

In conclusion regarding writing, in preparation for journal submission, keep these points in mind:

- Effective scientific writing conveys an idea clearly and concisely.
- Scientific writing should be easy and even enjoyable to read.
- Clear writing improves transparency and speeds up scientific progress.

### English science learning

Some points to consider for English science learning include: 1) Science reading study, 2) Practice writing a hypothetical draft abstract or paper, and 3) Scientific English language exposure by listening to media during your commute or exercise.

#### 1) Science reading study

Reading published physiology papers on a routine basis will build familiarity with the format and writing style used within journals that are pertinent to your specialty within physiology. In

addition to widening your vocabulary with specific terms used in your field, you can note the amount and type of background information given to orientate the reader, and the means used to transition between paragraphs and sections. In your careful reading of pertinent papers, observe how authors present their limitations and yet they finalize their Discussion with a positive conclusion.

Another way to increase science reading exposure is to join an English science rounds discussion of many gathered scientists. Participate by preparing a presentation on a published paper and then lead the discussion on the main points of the paper. Play the role of a reviewer, by searching for overlooked topics, unaddressed issues and areas that could use a more complete description or explanation.

## 2) Practice writing a hypothetical draft abstract or paper

In this exercise, read a paper of interest to you, cut out (or print) the figure(s) and table(s), and take specific notes on the main points of the paper. Put away the paper and then draft your own hypothetical structured abstract or short paper. Follow the generally recommended order for writing an original manuscript: a) Table titles and Figure legends, b) Results, c) Methods, d) Introduction, e) Discussion, f) Abstract, and g) Title. Compose appropriate table titles and figure legends, including acronym definitions and footnotes. Summarize the data in the Results, taking care to avoid repetition of the data that is already listed in the figures and/or tables. In the next part, make sure to include the steps undertaken and equipment used so that this study can be carried out by the information given in the Methods. For the Introduction, carefully consider how much background information the readers of that journal would need to understand the paper. Also

describe the reason for undertaking the study. In the Discussion, make sure to explain how the results are pertinent to the field and how they may be applied to future therapies or studies. Prepare a well-planned and concise Abstract that covers every point. Finally, develop a meaningful and interesting title which is focused. Congratulations, you have written an English (hypothetical) scientific paper; unfortunately, it cannot be submitted to a journal, but your next paper can be submitted!

## 3) Scientific English language exposure by listening to podcasts

As you already know, the best way to use free time is to engage yourself in an activity. For many of these activities, you can reap double benefits by listening to a radio or podcasts. During your physical exercise time, you can also be mentally exercising via scientific podcasts. There is a wide variety of freely available English podcasts which are dedicated to science topics. Please enjoy studying English via the following highly recommended science podcasts:

- NEJM This Week podcast (for MDs and residents) <https://player.fm/series/nejm-this-week-audio-summaries>
- Science Magazine podcast (for MDs, researchers and students) <https://www.stitcher.com/podcast/science-magazine-podcast>
- Science Friday podcast (for students, researchers, paramedical staff) <https://www.sciencefriday.com/>
- 60-Second Science podcast (for students, researchers, paramedical staff) <https://www.scientificamerican.com/podcasts/>
- NEJM Resident 360 podcast (for easy science conversation) [https://resident360.nejm.org/content\\_categories/109](https://resident360.nejm.org/content_categories/109)

### Great books

- How to Write, Publish, & Present in the Health Sciences: A Guide for Clinicians & Laboratory Researchers by Thomas A. Lang, Am College of Physicians, April 2010 ISBN-10: 1934465143
- Science Research Writing for Non-Native Speakers of English by Hilary Glasman-Deal, Imperial College Press, December 2009 ISBN-10: 184816310X
- How to Write and Publish a Scientific Paper by Robert A. Day and Barbara Gastel, Greenwood Pub Group, June 2011 ISBN-10: 0313391971

### Online Aids

- Medical Dictionary: <http://dictionary.reference.com/medical>
- Elements of Style by Strunk and White: <http://www.bartleby.com/141/index.html>
- Uniform requirements for manuscripts submitted to biomedical journals: Writing and editing for biomedical publication: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3142758/>
- Links to online Instructions to Authors for over 6000 journals: <http://mulford.utoledo.edu/instr/>

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