

2-Hour Lecture on Scientific Writing

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Today, I am going to talk about Scientific Writing, as Gaoyuan and I discussed earlier. However, Scientific Writing is such a big issue, that we certainly can not finish it within one or two classes, or even within a semester. Upon my understanding, almost every university in the United States will offer courses related to technical writings during undergraduate education. Although I myself received my Ph.D. degree in America, I had not taken such classes. So what I am going to teach today is mostly based on my experience in writing papers and dissertation, and on some of my readings. I will only introduce some basic ideas, give you some simple examples, and provide a general guide. Well, I wish after this time, you would start to pay attention to writing once you get chance to read, to write or even to listen to.

I know, many of you will continue your education after the 4-years' undergraduate life. Students who want to get a master or Ph.D. degree, for example, at Peking University will be required to publish your research results. Even if this is not the case, you can not avoid writing in your future work. Because you are studying chemistry, today I will mostly introduce ACS style in technical writing, where ACS is the abbreviation of American Chemical Society.

1)

Concerning the writing of a scientific paper, specific guideline for text length, preparation of figures and tables, and instructions on how to submit your paper differ from journal to journal and publisher to publisher. For ACS journals and special publications, read the Guide, Notes, Notices, or Instructions for Authors that appear in each publication's first issue of the year and on the World Wide Web at <http://pubs.acs.org>.

Writing a Scientific Paper
Guide, Notes, Notices, or Instructions for Authors
<http://pubs.acs.org>

2)

Although there is no fixed set of "writing rules" to be followed like a cook book recipe or an experimental procedure, some guidelines can be helpful. Let's start by answering some questions:

- What is the function or purpose of this paper?
- Are you describing original research results?
- Are you reviewing the literature?
- Something else?

How is your work different from that described in other reports on the same subject? Unless you are writing a review, be sure that your paper will make an original contribution. Some publishers, including ACS, do not publish previously published material.

What is the best place for this paper to be published?
Who is the audience?

Answering these questions will clarify your goals and thus make it easier for you to write the paper.

3)

Standard Format

Here shows an example of standard format when you organize your material into a paper. In the section of Introduction or Background, you may introduce why you choose your research topic, what have been done by others in this field; then comes with experimental details or theoretical basis, where you introduce how to do your experiments or how to calculate in your study; followed by results and discussion, which are the main body of the paper; Finally, go to conclusions.

This format has become standard because it is suitable for most reports of original research. It is basically logical, and it is easy to use. More importantly, it parallels the scientific method of deductive reasoning: define the problem, create a hypothesis, devise an experiment to test the hypothesis, conduct the experiment, and draw conclusions. Furthermore, this format enables readers to understand quickly what is being presented and to find scientific information easily.

4)

Components of a Paper

Let's go more details of this format. This transparency shows the components of a paper.

Title:

The title must be briefly and grammatically correct but accurate and complete enough to stay alone. 1) A two- or three-word title may be too short, but a 14- or 15-word title is unnecessarily long. 2) Avoid phrases such as "on the", "a study of", "research on", "report on", "regarding", and "use of". 3) In most cases, omit "the" at the beginning of the title. 4) Spell out all terms in title, and avoid symbols, formulas, and abbreviations. 5) Serious titles are of little value. Some publishers do not permit them at all. 6) If you can not create a title that is short, consider breaking it into title and subtitle.

Byline and Affiliation

Byline: 1) Include in the byline all those, and only those, who made substantial contributions to the work, even if the paper was actually written by only one person. 2) Use your first name, initial, and surname of each author as requested by publications. Many ACS publications request at least one full given name for each author, rather than only initials. 3) Do not include professional, religious, or official titles or academic degrees.

Affiliation: Affiliation is the institution at which the work was conducted. If there is more than one author, use an asterisk or superscript to indicate the author to whom correspondence should be addressed. This person is usually your boss, and he is fully responsible for the paper. For example, he will submit the paper, write to editors, answer the questions raised by reviewers, and revise the paper as suggested.

5)

Abstract: Most publications require an informative abstract for every paper, even if they do not publish abstracts. For a research paper, briefly state the problem or the purpose of the research, indicate the theoretical or experimental plan used, summarize the principal findings, and point out major conclusions. The abstract allows a reader to determine the nature and scope of the paper, and helps editors identify key features for indexing. Some tips: 1) The optimal length is one paragraph, and between 80 and 200 words is usually adequate. 2) Do not cite references, tables, figures in the abstract. Do not include equations, schemes, or structures that require display on a line separate from the text. 3) Use abbreviations only when it is necessary. Define abbreviation in the abstract (and again at first use in the text).

Introductions: A good introduction is a clear statement of the problem or project and the reasons that you are studying it. The body of the introduction part usually contains the following contents: 1) to give a concise and appropriate background discussion of the problem and also the significance, scope and limits of your work; 2) to outline previous work by citing pertinent literature; 3) to state how your work differs from or is related to work previously published, and the continuity from the previous work to yours.

6)

Experimental Details or Theoretical Basis:

This section may own different names such as “experimental methods”, “experimental section”, or “materials and methods”, and “theoretical calculations”, depending on specific journals or publications. In this section, you need to give sufficient details about your materials and methods so that others can repeat your work and obtain comparable results.

What we usually do in this part is outlined here:

- 1) Identify the materials used, but do not reference standard lab reagents;
- 2) Give the chemical names of all compounds and the chemical formulas of compounds that are new and uncommon;
- 3) Describe apparatus only if it is not standard or not commercially available;
- 4) Describe the procedures used, unless they are established and standard;
- 5) Note and emphasize any hazards, and include precautionary handling details and safety measurements;
- 6) In theoretical reports, include all background data, equations, and formulas necessary to the arguments, but not lengthy derivations, which may be

presented as Supporting Information.

7)

Results and Discussion

Results and Discussion can be presented either as two separate sections or as one combined section. In the section of Results, you need to summarize the data collected. If necessary, include equations, figures, and tables for clarity and brevity.

The purpose of the discussion is to interpret and compare the results. In this section, you need to relate your results to your original purpose in undertaking the project: Have you resolved the problem? What exactly have you contributed? You may also suggest further study in this section. Usually, Results and Discussion are the most important components of a paper.

8)

Conclusions and Summary

The purpose of the conclusion is to put the interpretation into the context of the original problem. Do not repeat discussion points or include irrelevant material. And your conclusions should be based on the evidence presented.

The function of summary is similar to that of conclusions. A summary is unnecessary in most papers. However, in long papers, a summary of the main points can be helpful. Keep in mind that a summary should be short.

9)

Acknowledgments

Generally, the last paragraph of the paper is the place to acknowledge people, organizations, and financing. Do it as simple as possible. It is important to follow the journal's guidelines on what to include in the Acknowledgments section.

References

In ACS books and most journals, the style and content of referenced are standard. So, you need to follow the reference style. The best way is to check the journal you like to publish your paper.

Special Sections and Supporting Information

Special Sections and Supporting Information are not required sections in many journals. However, if you have large tables, extensive figures, lengthy experimental procedures, mathematical derivations, analytical and spectral characterization data and so on, you may include these in the section of Supporting information.

10)

Writing Style and Word Usage

Now, we have had too much for the components of a paper. It has 7 slides already. Let's change a topic, shift away from the components of a paper, and go to writing style and word usage.

When you are writing information that will be read in English by non-native speakers, and particularly, when authors themselves are not native English speakers like us, these approaches can be helpful. You may use “minimum word strategy” and use Controlled English and Global English. Both Controlled English and Global English impose some restrictions on writing style and terminology. And the Controlled English is more restrictive than Global English. We will not go in details today, because these approaches are not very much emphasized in ACS style.

Here are some tips for us in technical writing: It is better to start with simple declarative sentences; Write in your own style, but keep in mind that the scientific writing is not literary writing, because a scientific writing requires the precise and the unambiguous.

In the following part of the class today, I will provide some examples in terms of writing style and word usage. Before doing that, let’s have some advice from the authorities in scientific writing. Here presented an advice from Maeve O’Connor: “The best writing in science, as elsewhere, is simple, clear, precise, and vigorous. Decide what you want to say and say it as simply, informatively, and directly as possible.”

11)

Choosing the correct word or phrase

Use appropriate verb tense

Simple past tense is correct for stating what was done;

Present tense is correct for statements of fact;

Present and simple past tenses may both be correct for results, discussions and conclusions.

Use an affirmative sentence rather than a double negative.

Watch the placement of the word “only”. It has different meanings in different places in the sentence.

Be sure that the antecedents of this and that are clear.

Use the proper subordinating conjunctions. While and since have strong connotation of time. Do not use them when you mean although, because or whereas.

Use the more accurate terms “greater than” or “more than” rather than over or in excess of.

12)

Words and Phrases to Avoid

“Be brief” is the principle in the scientific writing. Cut the unnecessary words always.

13)

Editorial Style

Next, I will present recommended stylistic and editorial conventions, mainly but not solely for ACS publications. The style recommended by ACS is, for the most part, taken from established authoritative sources, such as *The Chicago Manual of Style*,

Words into Type, and the U.S. Government Printing Office Style Manual.

Hyphenation

Let's start with hyphenation.

1) Prefixes

Most prefixes are not hyphenated. Do not hyphenate following prefixes when added to words that are not proper nouns.

However, hyphens are sometimes used when letters are doubled, or when more than one prefix is present.

2) Suffixes

Abbreviation

An abbreviation is short form of a word; often the individual letters are pronounced. In an acronyms, the letters always form a pronounceable word. ACS is an abbreviation, while IUPAC (International Union of Pure and Applied Chemistry) is an acronym. If you check out the web site of ACS, you can find a list of ACS-recommended abbreviations. Again, we will go through quickly for this part.

If a very long name or term is repeated many times throughout a paper, an abbreviation is needed. Place the abbreviation in parentheses following the spell-out form the first time it appears in the text. If it is used in the abstract, define it in the abstract and again in the text.

14)

Gender-Neutral Language

The U.S. government and many publishers have gone to great efforts encouraging the use of gender-neutral language in their publications. Recent style guides and writing guides urge copy editors and writers to choose terms that do not reinforce outdated sex roles. Gender-neutral language can be accurate and not necessary awkward. 1) Instead of "man", use "people, human beings or human species", depending on your meaning. 2) Instead of "manpower", use "workforce, staff, workers, labor, crew, employees, or personnel", depending on your meaning. 3) Instead of "manmade", use "synthetic, artificial, built, manufactured and factory-made". 4) Instead of "he" and "his", change the construction to a plural form (they and theirs) or first person (we, us ours). 5) Instead of "wife", use "family or spouse" where appropriate.

15)

Numbers, mathematics and units of measure

Usually, the usage of style conventions for numerals and words are different for technical and non-technical material. Let's see some of examples.

1) Use numerals with units of time or measure, and use a space between the numeral

and the unit, except %, \$, and angular degree, angular minutes and angular seconds.

- 2) With items other than units of time or measure, use words for cardinal numbers less than 10, use numerals for 10 and above. Spell out ordinals “first” through “ninth”, use numerals for 10th and greater. But there are exceptions.
 - a. Use all numbers in a series or range containing numbers 10 or greater. For example, the 2nd and 10th samples.
 - b. Use all numerals for numbers modifying nouns in parallel construction in the same sentence if one of the numbers is 10 or greater.
 - c. For very large numbers used in a non-technical sense, use a combination of numerals and words.
- 1) When a sentence starts with a specific quantity, spell out the number as well as the unit of measure. However, if possible, you may recast the sentence.
- 2) Even when a sentence starts with a spell-out quantity, use numerals when appropriate in the rest of the sentence.
- 3) Also, we need to use numerals for expressions used in a mathematical sense.
- 4) When the suffix “fold” is used in a non-mathematical sense, spell out the accompanying number even if it is less than 10.

- 1) In dates, use numerals without ordinal endings.
- 2) Use numbers for decades, and form their plurals by adding an “s”. Do not use apostrophes in any position.
- 3) Now let’s discuss on the numbers of long digits:

If a number is long, this means, it is with five or more digits, we need to consider the grouping of digits. You need to check the publication in which your manuscript will appear. Two styles are possible. In some publications, for numbers with five or more digits, the digits are grouped with commas. But in some publications, the digits are grouped with a thin space. Examples of both cases are shown here. Keep in mind, that numbers of four digits are not necessary to be grouped.

There are also exceptions. U.S. monetary values are always written with commas, never with a thin space. Similar to this, U.S. patent numbers are always written with commas. Another exception is page number in reference citation, and they are always printed solid without commas, without a thin space.

Certainly, there are many other rules in the usage and style of numbers and units. The best thing is to read the publication and get the information you need.

16)

Usage and Style for Symbols

Now let’s go the section of the usage and style for symbols. We’ll just go quickly.

- 1) Define all symbols for mathematical constants, variables, and unknown quantities the first time you use in the text. If you use them in the abstract, define them there and then again at their first appearance in text. But, do not define standard mathematical constants such as ‘pai’.

- 2) Form the plurals of mathematical symbols by adding an apostrophe and s if you can not use a word such as values or levels.
- 3) Do not use an equal sign as an abbreviation for the word “is” or “equals” in text.
- 4) Do not use a plus sign as an abbreviation for the word “and”.

These are only some examples for the general rules. This next slide gives more respects in the usage and styles for symbols which you need to pay attention to when you write a paper. You need to pay attention to which type of word should be used: italic type, roman type, or boldface type? Also, you need to learn correct use of Greek letters, spacing, enclosing marks, subscripts and superscripts, abbreviation and symbols, equation, and special notation.

17)

References

In the following part, I will present style conventions for citing reference. In ACS publications, you may cite references in three ways.

- 1) By superscript numbers. The superscript numbers appear outside the punctuation if the citation applies to a whole sentence or a clause;
- 2) By italic numbers on the line and in parentheses inside the punctuation;
- 3) By author name and year of publication in parentheses inside the punctuation.

In ACS books, all three of these systems are used, depending on the subject and series. Also, in all three systems, the author's name may be made part of the sentence.

18)

Style for Reference Lists

Books:

When a book has authors and no editors, it means either that the entire book was written by one author or that two or more authors collaborated on the entire book.

When a book has editors, it means that different authors wrote various parts of the book independently of each other. The word ‘In’ before the book title indicates that the authors mentioned wrote a part of the book, not the entire book.

19)

Conventions in Chemistry

Conventions in Chemistry are related to the use of typefaces (roman, italic, and bold), Greek letters, superscript and subscripts, and special symbols that are commonly used in chemistry.

20)

Editorial Procedures

For ACS books and journals, the specifics may differ from office to office, but the general procedures for processing manuscripts from review through publication are

similar.

Papers submitted to ACS books and journals are considered for publication with the understanding that they have not been published or accepted for publication elsewhere.