Writing good scientific papers

MPIP, Mainz, 04/2016

- **Outline**

- **Presentation**
- Basic principles
- Structure of a journal paper
- Language issues
- ---
- **Exercises** (in small groups)
- ---
- Presentation of results, discussion
- Concluding remarks

- **Aspects of writing a paper:**

- **Contents**
- **Language**
- **Figures and Tables**
- **Literature (introduction, discussion)**
- **Choosing a Journal**
- **First draft**
- **Submitting draft to supervisor**

- **Eighteen Suggestions for Writing Good Scientific Papers:**

- **Taken (and shortened!) from:**
- http://course1.winona.edu/mdelong/EcoLab/21%20Suggestions.html

- **1. Know your audience and write for that specific audience.**

- Scientific and technical writing is never a 'general purpose‘, but written for a specific audience, i.e. the community who read a particular journal or study a particular subject.

- You must adopt the style and level of writing that is appropriate for your audience. Study them as they are manifested in a selection of highly regarded papers and in the "Instructions for Authors" for key journals.

- **2. Your supervisor/professor is not here to teach you basic grammar and spelling.**

- The more time and emotional energy she or he spends on correcting basic English usage, the less remains for issues of content or fine-tuning. You are responsible for mastering the basics of the language. With word processors and spellcheckers having become standard writing tools, typos or other spelling errors should be very rare.

- **3. Do Not Turn in a First Draft!**

- Ever! Most people's first drafts are terrible. "Good writing is rewriting," and you should make a serious effort at editing, rewriting, and fine-tuning before you give the manuscript to anyone else to read. If you need to put a piece of writing away for a few days before you can approach it dispassionately enough to rework it, do so.

- **4. Avoid abusing word forms.**

- Use words in the form that conveys your meaning as clearly and simply as possible.

- For example, consider the sentence, "The low rate of encounters was a reflection of population density reductions." versus: "The low rate of encounters reflects a reduced population density."

- **5. Do not use more words where fewer will do.**

- Do not use long words where short ones will do.

- For example:
- "utilization" vs. "use"
- "in order to" vs. "to"

- Do not use special words to make your writing seem more technical, scientific, or academic when the message is more clearly presented otherwise.

- **6. Use an outline to organize your ideas and writing.**

- When you first start a writing project, make an outline of the major headings. List the key ideas to be covered under each heading. Organize your thinking logic and the logic of your arguments at this level, not when you are trying to write complete, grammatical, and elegant sentences.

- Separate out the three tasks of: (1) figuring out what you want to say, (2) planning the *order* and *logic* of your arguments, and (3) crafting the exact language in which you will express your ideas.

- **7. Think about the structure of paragraphs.**

- Though most students can write reasonable sentences, a surprising number have difficulty organizing sentences into effective paragraphs. A paragraph should begin with a topic sentence that sets the stage clearly for what will follow. Make topic sentences short and direct. Build the paragraph from the ideas introduced in your topic sentence and make the flow of individual sentences follow a logical sequence.

- **8. Pay attention to tenses.**

- Problems of inappropriate or inconsistent tenses are common in student writing. What you, or others, did in the past should be stated in the past tense (e.g. data were collected...."). Events or objects that continue to happen or exist can be described in the present tense (e.g., "in this paper, I *examine*..... The data reject the hypothesis that.....). Whatever tense you choose, be consistent.

- Be careful in using "might," "may," and "would" (as in "this might indicate that..."). They are frequently used as ways of weaseling out of making a clear statement.

- **9. Captions should not merely name a table or figure, they should explain how to read it.**

- A caption (figure or table heading) should contain sufficient information so that a reader can understand a table or figure, in most cases, without reference to the text. Very simple tables and figures may require only a title for clarity, and exceptionally complex ones may require reference to the text for explanation.

- Do not leave caption writing to the end of the project; write captions when you organize your Results section and it will help you write the text.

- **10. When citing a reference, focus on the ideas, not the authors.**

- Unless the person who reported a result is an important point in a statement, literature citations should be parenthetical, rather than in the body of the sentence: “… growth rates of > 80 cm are common in populations in Alberta (Marx 1982)." rather than “…, Marx (1982) found growth rates of >80 cm to be common in populations in Alberta.'

- **11. Show us don't tell us.**

- Rather than telling the reader that a result is interesting or significant, show them how it is interesting or significant. For instance, rather than 'The large difference in mean size between population C and population D is particularly interesting," write 'Mean size generally varied among populations by only a few centimeters, but mean size in populations C and D differed by 25 cm.“.

- **12. Write about your results, not your tables, figures, and statistics.**

- Confusing and disjointed Results sections often arise because the writer does not have a clear idea of the story she/he intends to tell. When preparing to write your results, decide on the elements of the story you wish to tell, then choose the subset of text, figures, and tables that most effectively and concisely coveys your message. Organize this subset of tables and figures in a logical sequence; then write your story around them.

- **13. Develop a strategy for your Discussion.**

- Many novice paper writers begin their Discussion section with a statement about problems with their methods or the items in their results about which they feel most insecure. Unless these really are the most important thing about your research (in which case you have problems), save them for later. Begin a Discussion with a short restatement of the most important points from your results. Use this statement to set up the ideas you want to focus on in interpreting your results and relating them to the literature. Use sub-headings that structure the discussion around these ideas.

- Note: Often 1 “results and discussion” section!

- **14. Introductions and conclusions are the hardest parts.**

- Many technical writers prefer to write their introductions last because it is too difficult to craft that balance of general context and specific focus required for a good introduction. If you need to write the introduction first to set the stage for your own thinking, resist the temptation to perfect it. The introduction will likely need substantial modification by the time you have finished the rest of the paper. The same concerns apply to conclusions, abstracts, and summaries. These components of the paper are all that many people will read, and you must get your message across in as direct, crisp, and enticing a manner as possible.

- **15. Break up large projects into small pieces and work on the pieces.**

- Writing and analysis for any given paper is often an iterative process. Writing the results section of a paper is often the best way to discover the analyses and figures that still need to be done.

- **16. Make your writing flow and resonate.**

- Papers written so well that they 'flow and resonate' are much more likely to influence your readers than the equivalent message presented in a form that is merely clear. When you find a paper that succeeds in this, study carefully how the authors constructed their augments and used language; try to identify what makes the paper work so well.

- **17. Use word processors effectively and back up your work religiously.**

- You need not learn how to use all the more exotic features of your word processor, but learn the options that are available and how to find out the details when you need them. Minimally, be familiar with basic requirements for document formatting and basic operating system requirements. The same comments apply to the use of statistical packages, graphics programs, and spreadsheets.

- **18. Take editorial comments seriously.**

- It may be clear from an editor's comments that they did not understand the point you were making. If so, that is a clear indication that you need to improve your writing. Also, an editor, no matter who they might be, has invested their time to help improve the quality of your writing. Respect their investment.

- **The structure of a journal paper**

- http://classweb.gmu.edu/biologyresources/writinggguide/ScientificPaper.htm

The Scientific Paper

- A well-written scientific paper explains the scientist's motivation for doing an experiment, the experimental design and execution, and the meaning of the results. Scientific papers are written in a style that is exceedingly clear and concise. Their purpose is to inform an audience of other scientists about an important issue and to document the particular approach they used to investigate that issue.

- Please do not think that good English is not critical in science writing. In fact, scientists try to be so concise that their English should be better than that of workers in other disciplines! If English is not your first language, then proofreading by a native-speaker might be helpful.

- If you have read scientific papers, you will have noticed that a standard format is frequently used. This format allows a researcher to present information clearly and concisely.

- **Types of title that can be used for scientific papers**

- **Indicative titles** indicate the subject matter of a paper but give no indication of any results obtained or conclusions drawn e.g. *The effectiveness of bed nets in controlling mosquitoes at different seasons of the year.*

- **Informative titles** give an indication of results achieved and conclusions drawn as well as the subject matter of the paper e.g. *Bed nets control mosquitoes most effectively when used in the rainy season.*

- **Question-type titles**
- This type of title obviously asks a question. e.g. *When are bed nets most effective when used to control mosquitoes?*

- **Main-subtitle (series) type**
- This approach is not liked by editors of scientific journals because if they accept the first paper they will be duty bound to accept sequels. e.g. *The effect of bed nets on mosquitoes: 1.Their effectiveness when used only in the rainy season.*

- **General organization**

- **(1) Abstract**
- **(2) Introduction**
- **(3) Methods**
- **(4) Results / Results and Discussion**
- **(5) Discussion / Conclusion**
- **(6) Literature Cited**

The Scientific Paper: Abstract

- An abstract is a shortened version of the paper and should contain all information necessary for the reader to determine:
- (1) what the objectives of the study were;
- (2) how the study was done;
- (3) what results were obtained;
- (4) and the significance of the results.

- Frequently, readers of a scientific journal will only read the abstract, choosing to read at length those papers that are most interesting to them. For this reason, and because abstracts are frequently made available to scientists by various computer abstracting services, this section should be written carefully and succinctly to have the greatest impact in as few words as possible.

- Although it appears as the first section in a paper, most scientists write the abstract section last.

The Scientific Paper: Introduction

- Why is this study of scientific interest and what is your objective?

- This section discusses the results and conclusions of previously published studies, to help explain why the current study is of scientific interest.

- The Introduction is organized to move from general information to specific information. The background must be summarized succinctly, but it should not be itemized. Limit the introduction to studies that relate directly to the present study. Emphasize your specific contribution to the topic.

- The last sentences of the introduction should be a statement of objectives and a statement of hypotheses. This will be a good transition to the next section, Methods, in which you will explain how you proceeded to meet your objectives and test your hypotheses.

- **How to Cite Sources in the Introduction Section**

- It is important to cite sources in the introduction section of your paper as evidence of the claims you are making. There are ways of citing sources in the text so that the reader can find the full reference in the literature cited section at the end of the paper, yet the flow of the reading is not badly interrupted.

- Note that articles by one or two authors are always cited in the text using their last names. However, if there are more than two authors, the last name of the 1st author is given followed by the abbreviation et al.. It is acceptable, and encouraged, to cite more than one source for a particular statement. This gives the statement more validity in its context and suggests that your research was thorough.

The Scientific Paper: Methods/Materials

- This section provides all the methodological details necessary for another scientist to duplicate your work.
- It should be a narrative of the steps you took in your experiment or study, not a list of instructions such as you might find in a cookbook.
- An important part of writing a scientific paper is deciding what bits of information needs to be given in detail. Do not quote or cite your laboratory manual!
- Sometimes, experimental details are given as supplementary part!

• The Scientific Paper: Results

- This section presents the results of the experiment but does not attempt to interpret their meaning. As with the Methods section, the trick to writing a good Results section is knowing what information to include or exclude. You will not present the raw data that you collected, but rather you will summarize the data with text, tables and/or figures. Use the text of the paper to state the results of your study, then refer the reader to a table or figure where they can see the data for themselves.

Note: **In most papers nowadays:**

1 section "Results and Discussion"

- **Do not include the same data in both a table and a figure.**

- It is best to present the data in a table unless there is visual information that can be gained by using a figure. For example, a figure is useful for reporting a regression analysis (line graph). Each table and figure has several lines of text in the caption that explain the information that is being presented; this is, they are made to stand alone. A table's legend appears above it, while the legend for a figure appears below the figure. If your table includes the results of a statistical analysis, be sure to provide the information necessary for the reader to properly evaluate the analysis (sample size etc.).

- **Additional tips on the Results section:**

- Number tables and figures separately beginning with 1.

- Do not attempt to evaluate the results in this section. Report only what you found; hold all discussion of the significance of the results for the Discussion section. **(see note above!)**

- It is not necessary to describe every step of your statistical analyses. Likewise, cite tables and figures without describing in detail how the data were manipulated. Explanations of this sort should appear in a legend or caption written on the same page as the figure or table.

- You must refer in the text to each figure or table in your paper.

- Tables generally should report summary-level data, such as means ± standard deviations, rather than all your raw data.

- Only use a figure (graph) when the data lend themselves to a good visual representation. Avoid using figures that show too many variables or trends at once.

The Scientific Paper: Discussion

- In this section, you are free to explain what the results mean or why they differ from what other workers have found.

- You should interpret your results in light of other published results, by adding additional information from sources you cited in the Introduction section as well as by introducing new sources. Make sure you provide accurate citations.

- Relate your discussion back to the objectives and questions you raised in the Introduction section. However, do not simply re-state the objectives. Make statements that synthesize all the evidence (including previous work and the current work).

- Limit your conclusions to those that your data can actually support. You can then proceed to speculate on why this occurred and whether you expected this to occur, based on other workers' findings.

- Suggest future directions for research, new methods, explanations for deviations from previously published results, etc.

- **How to Cite Sources in the Discussion Section**

- It is important to cite sources in the discussion section of your paper as evidence of the claims you are making. There are ways of citing sources in the text so that the reader can find the full reference in the literature cited section at the end of the paper, yet the flow of the reading is not badly interrupted (see also Introduction).

- Make sure you give a full citation in the Literature Cited section ("references") for all sources mentioned in the text.

The Scientific Paper: Literature Cited

- This is the last section of the paper. Here you should provide an alphabetical (or numbered according to the occurrence in your paper) listing of all the published work you cited in the text of the paper.

  Note: in most journals, listed and numbered according to sequential appearance in text!

- A standard format is used both to cite literature in the text and to list these studies in the Literature Cited section. Consult a recent issue of the respective journal for guidance.

- For papers published in journals you must provide the date, title, journal name, volume number, and page numbers. For books you need the publication date, title, publisher, and place of publication.

Practical Tips for Scientific Writing

- (compiled from V.E. McMillan's Writing Papers in the Biological Sciences , a highly recommended resource for scientific writing).

- PROOFREAD!!! You should check your paper to catch and correct these and other common errors:

- You should avoid **abbreviations** by writing out the full word (minimum, October, first, temperature, ...). Exceptions include common terms like ATP and DNA, units of measure (m, g, cm, °C), and mathematical or chemical formulas. Sentences should never begin with an abbreviation or an acronym.

- You may wish to introduce an **acronym** for a term that is repeated often: if your paper deals with soybeans, *Glycine max*, you may use the full scientific name once and substitute *G. max* thereafter.

- **Chemical elements** are not proper nouns, so do not capitalize them. Only the first letter of the symbol is a capital letter: nitrogen (N), carbon (C), calcium (Ca).

- In formal writing, you should never use **contractions** (didn't, can't, haven't...).

- The word "**data**" is plural, as in "the data *were* collected on January 21, 2001."

- **Direct quotes** should be avoided, unless you are presenting another author's specific definition or original label. You can usually paraphrase the writing effectively and more concisely, taking care to properly attribute the sources of your statements.

- Read and re-read your **references**. Consult a textbook or another reference to help you resolve any aspects of the paper you do not understand before you start writing.

- You should **review** your writing to make sure that each sentence presents one or two clear ideas. This will also help you organize sentences within paragraphs in a logical order.

- In science, the word "**significant**" implies the result of a statistical test. You should analyze your results to determine whether they are statistically significant and report the test you used.

- Do not use **slang**. Try to use precise, scientific terms where possible (without unnecessary jargon) and avoid colloquialisms and figures of speech: "somewhat" rather than "sort of," "many" or "a great deal" instead of "a lot."

- Your word processor's **spell-check** and/or grammar-check function is not error-free. It cannot tell you when to use "it's" and "its," and it cannot tell you that a particular sentence does not make sense. Give yourself enough time to proofread and correct your paper.

- **Tenses**

  When describing methods and results, you should use the past tense. The present tense is appropriate for accepted facts, such as the background information presented in the Introduction. In addition, you may use the present tense when you discuss your results and conclusions. Looking over other scientific papers may help you answer questions you might have on this topic.

- **Units**

  All units of measure must be metric or SI (international System).

- **Scientific writing**
- **Scientific English**
- **Style of writing and use of English in essays and scientific papers**

- http://en.wikipedia.org/wiki/Scientific_writing

- **I. Language**

- **Three aspects of style seem to cause problems:**

- Division of the text into sentences and paragraphs. Sentences should have only one idea or concept. In general, sentences in scientific prose should be short, but full stops should not be added so liberally that the writing does not flow. The use of paragraphs helps the reader to appreciate the sense of the writing.

- Superfluous phrases and words should be avoided. Do not write phrases such as "It is also important to bear in mind the following considerations". Most woolly phrases can be omitted or replaced by a single word.

- Try to use familiar, precise words rather than far-fetched vague words. "Cheaper" may replace "More economically viable", and ongoing situation" doesn’t mean very much.

- **Tense and mood**

- Write in past tense unless you are describing present or future situations. Use the active voice rather than the passive voice.

- For example, instead of writing "The food was eaten by the pig", write "The pig ate the food". The active voice is easier to read and reduces the sentence length

- It can be acceptable to write in more than one tense in the literature review e.g. "Brown (1995) showed that the brain is more fully developed at birth than other organs". In this case the present tense can be used for the second half of the sentence because its gives knowledge that is universally accepted.

- Materials and methods should be written in the past tense. "The experiment was designed in the form of a 6 x 6 Latin square." Remarks about Results should mainly be in the past tense. "When a high protein diet was fed to rabbits they grew rapidly."

- **Sentence construction**

- The purpose of any paper is to convey information and ideas. This cannot be done with long involved sentences. Keep sentences short, not more than 30 words in length. A sentence should contain one idea or two related ideas. A paragraph should contain a series of related ideas.

- **Choice of words**

- Words have precise meanings and to use them correctly adds clarity and precision to prose. Look at the following pairs of words that are often used in scientific texts. Learn how to use them correctly: Fewer, less; infer, imply; as, because; disinterested, uninterested ; alibi, excuse ; data, datum; later, latter; causal, casual; loose, lose; mute, moot; discrete, discreet. See, for example: *Less active blood cells* vs.

  Fewer active blood cells

- Use a standard dictionary and Roget's Thesaurus of English Words and Phrases to find the correct meaning of words.

- **Use of pronouns**

- When you write ‘it’, ‘this’, ‘which’ or ‘they’ are you sure that the meaning is plain? A pronoun usually deputizes for the nearest previous noun of the same number (singular or plural) - *The cows ate the food; they were white. The cows ate the food; it was white.*

- **Correct spelling, including the use of plurals**

- Some words have alternative spelling e.g. tyre, tire, grey, gray; draft, draught, often the difference is between the American and British spelling. In other cases an apparent misspelling is a misuse of a word e.g. practice, practise.

- The plural of many words in English is achieved by adding an s (or es) to the single. However some words have the same form in both the singular and plural. Other words are already plural such as people and equipment, so don't use peoples (unless you are referring to different groups of people or different ethnic groups) and equipments. Adopted words sometimes take on the plural of the original language, for example datum becomes data and fungus become fungi.

- **Use of abstract words**

- Use the concrete and not the abstract to achieve clarity and precision: "Cessation of plant growth operated in some of the plots." Obviously a cessation cannot operate (Some plots of plants did not grow during the trial)

- The abstract noun basis is commonly overworked. "Measurement of storm intensity involves recording staff to be available both day and night on a 24 hour basis." "To measure storm intensity recording staff have to be in duty throughout the day and night."

- **Be careful with the use of the present participle(Gerund):**

- *After standing in boiling water for an hour, examine the flask.*

- The gerund always ends in 'ing.' If the sentence is left without a subject (a hanging participle) then the action of the verb is transferred to the person taking the action.

- **Misuse of emotional words (avoid)**

- One cannot develop a logical argument using emotional words: e.g. *progressive, reckless, crank, sound, good, correct, improved, superior.*

- **Superlatives**

- Very, more, much, have a place when used economically. As superlatives they are out of place in scientific writing. Superlatives such as gigantic, earth shattering or fantastic should never be used.

- **Qualifying the absolute**

- Some adjectives are absolute and cannot be modified such as: sterile or unique. Other adjectives, such as pregnacy, have to be qualified with care. A petri dish is either sterile or not sterile. It cannot be very sterile, quite sterile or fairly sterile; An object is unique, and although a woman can be recently pregnant, she can't be slightly pregnant.

- **Loose expressions (avoid)**

- *In each selected village 30 farmers were interviewed, namely 10 large, average and small farmers.* Is the reference here to the size of the farmers or to the size of their farms?

- **Grandiloquence**

- Avoid the use of scientific jargon. The aim in scientific writing is to inform using simple language not to confuse by the use of grandiose sounding words and phrases.

- Grandiloquent phrase: *The ideal fungicide ... must combine high fungitoxicity with low mammalian toxicity and phytotoxicity, and with an absence of tainting or other deleterious side effects when the fruit is processed*.

- Simple replacement: *The ideal fungicide ... must kill fungus effectively, but must be harmless to animals and plants, and must cause no tainting or other harmful side effects when the fruit is processed.*

- **Genteelism**
- *"I"* is not immodest in a research worker and therefore use it (although not to excess), NOT *"The present writer"* or *"The author of this communication".*
- **The Misuse of the definite article "*The*"**
- Avoid overuse of the word "*the*" . Only use when it applies to a particular item that has been referred to before. All others could be omitted.
- **The excessive use of the pronoun *"it"***
- Avoid excessive use of the indefinite pronoun "*it*".
- "*It would thus appear that*" can be replaced by "*apparently*";
- "*It is evident that*" by "*evidently*";
- Other commonly used phrases such as: "*It will be seen that*"; "*It is interesting to note that*" and "*It is thought that*", can be left out without any meaning being lost.

- **Avoid verbal obscurantisms and use simple words**

- Some phrases show sloppy thinking. For example the phrase *'It has long been known that*' usually means that the writer has not bothered to look up the reference.

- *'Correct to an order of magnitude'* probably means that the answer was wrong.

- *'Almost reached significance at the 5% level'* usually means a selective interpretation of results.

- Text is easier to understand if simple words and phrases can be used to replace more complex or foreign ones. For example *analogous* can be replaced by *similar* ; *utilise* by *use*; *terminate* by *end.*

- **Punctuation**

- **Colon (:) and semi colon (;)**
- A colon is used when a list or explanation follows, a semi colon is used to separate two or more related clauses provided each clause forms a full sentence.

- **Commas**
- A comma is put in a sentence to denote a brief pause between groups of words:
- *I will show you the paper about which I was speaking, but it is not as useful as I first thought.*

- Or to separate subclauses:
- *Professor Brown, who is in charge of recruiting for the University, said that the latest estimates were higher than those for this time last year.*
- Finally to separate all items in a list except for the last two:
- *The following items may be imported duty free into Azania: Animals, cereals, plants, fruit, trees, legumes and nuts.*

- **Other points concerning the use of English**

- A singular verb must always be associated with a singular noun. Similarly a plural verb with a plural noun. Difficulties arise especially with nouns like, for example, livestock and data, which are plural.

- **Numbers and Units**

- Quantities should be given only as many significant figures as can be justified. For example the metabolic rate of an animal should not be quoted as 326.18W if it can be measured to only within about 5%. It should be written as 330W.

- The figures within a number should be grouped in threes (with a small space between each group) so that they are easier to read. Commas should be avoided. For example: 21 306.1 not 21,306.1

- Concerning units, the Systeme International (SI) should be used where possible.

- When incorporating statistical data into the text, the test used (eg chi squared) should be included.

- **Dictionaries**
- **Concise Oxford Dictionary (BE)**
- **Random House Dictionary (AE)**
- **Merriam-Webster Dictionary (www.m-w.com)**

Common differences in spelling

AE	BE	AE	BE
color	colour	center	centre
organization	organisation	dialog	dialogue
traveling	travelling	defence	defense
recognize	recognise	analyze	analyse

Tenses

AE	BE
burned/was burned	burnt/was burnt
learned/has learned	learnt/has learnt

- (see also: dream, kneel, lean, leap, spell, spill, spoil)

- http://www.ag.iastate.edu/aginfo/checklist.php

- **Word Usage in Scientific Writing**

- The following list includes some of the troublesome words, terms, and expressions most frequently found in Experiment Station journal paper and bulletin manuscripts. In reporting and recording research, try to be as accurate and precise in describing it as in doing it. Avoid the ambiguous and "faddish." For the benefit of international readers, especially, use standard words in their established meanings.

- **Above** ("the above method," "mentioned above," etc.) -- Often, you are referring to something preceding, but not necessarily *above*; a loose reference, convenient for writers, but not for readers. Be specific. You know exactly what and where, but your readers have to search.

- **Affect, effect** -- Affect is a verb and means to *influence.* Effect, as a verb, means to *bring about*; as a noun, effect means *result.*

- **All of, both of** -- Just "all" or "both" will serve in most instances.

- **Alternate, alternative** -- Be sure which you mean.

- **And** (to begin a sentence) -- You have been told not to do this in grade school. But teacher's purpose was to keep you from using fragmentary sentences; either "and" or "but" may be used to begin complete sentences. And both are useful transitional words between related or contrasting statements.

- **Apparently (apparent)** -- means *obviously, clearly, plainly evident*, but also means *seemingly* or *ostensibly* as well as *observably.* You know the meaning that you intend, but readers may not. Ambiguity results. Use *obvious(ly), clear(ly), seeming(ly), evident(ly), observable* or *observably,* etc., as needed to remove doubt.

- **Appear, appears** -- Seem(s)? "He always *appears* on the scene, but never *seems* to know what to do." "Marley's ghost *appeared* but *seemed* harmless.“

- **At the present time, at this point in time** -- Say "at present" or "now" if necessary at all.

- **Below** -- See comment about *above.*

- **But** (to begin a sentence) -- see "And" and "However".

- **By means of** -- Most often, just "by" will serve and save words.

- **Case** -- Can be ambiguous, misleading, or ludicrous because of different connotations; e.g., "In the case of Scotch whiskey,...." *Case* also is a frequent offender in padded, drawn-out sentences. For "in this case," try "in this instance.“

- **Commas and punctuation** -- The trend is toward less punctuation (particularly fewer commas), but that demands careful writing, without misplaced or dangling elements. Do **not** omit commas before the conjunctions in compound sentences. Most journals, but not all, use final commas before "and" or "or" in series; check the journal.

- **Compare with, compare to** -- Compare *with* means to examine differences and similarities; compare *to* means to represent as similar. One may conclude that the music of Brahms compares *to* that of Beethoven, but to do that, one must first compare the music of Brahms *with* that of Beethoven.

- **Comprise** -- Before misuse, comprise meant to contain, include, or encompass (not to constitute or compose) and still does, despite two now opposite meanings. Use and meanings now are so confused and mixed that "comprise" is best avoided altogether.

- **Correlated with, related to** -- Although things may be *related to* one another, things are *correlated with* one another.

- **Different from, differ with** -- Different from! Also, one thing *differs from* another, although you may *differ with* your colleagues.

- **Due to** -- Make sure that you don't mean *because of.* Due is an adjective modifier and must be directly related to a noun, **not** to a concept or series of ideas gleaned from the rest of a statement.

- **During the course of, in the course of** -- Just use "during" or "in.“

- **Either....or, neither...nor** -- Apply to no more than two items or categories. Similarly, *former* and *latter* refer only to the first and second of only two items or categories.

- **Etc.** -- Use at least two items or illustrations before "and so forth" or "etc.“

- **Experience(d)** -- To experience something is sensory; inanimate, unsensing things (lakes, soils, enzymes, streambeds, farm fields, etc.) do not experience anything.

- **Following** -- "After" is more precise if "after" is the meaning intended. "After [not *following*] the procession, the leader announced that the ceremony was over.“

- **High(er), low(er)** -- Much too often used, frequently ambiguously or imprecisely, for other words such as *greater, lesser, larger, smaller, more, fewer*; e.g., "Occurrences of higher concentrations were lower at higher levels of effluent outflow." One interpretation is that greater concentrations were fewer or less frequent as effluent volume(s) increased, but others also are possible.

- **However** -- Place it more often within a sentence or major element rather than at the beginning or end. "But" serves better at the beginning.

- **Hyphening of compound or unit modifiers** -- Often needed to clarify what is modifying what; e.g., a small-grain harvest (harvest of small grain) is different from a small grain harvest (small harvest of *all* grain), a batch of (say, 20) 10-liter containers is different from a batch of 10 [1-] liter containers, *and a man eating fish is very different from a man-eating fish!*

- **In order to** -- For brevity, just use "to"; the full phrase may be used, however, [in order] to achieve useless padding.

- **Irregardless** -- No, *regardless*. But *irrespective* might do.

- **It should be mentioned, noted, pointed out, emphasized, etc.** -- Such preambles often add nothing but words. Just go ahead and say what is to be said.

- **It was found, determined, decided, felt, etc.** -- Are you being evasive? Why not put it frankly and directly? (And how about that subjective "felt"?)

- **Less(er), few(er)** -- "Less" refers to quantity; "fewer" to number.

- **Majority, vast majority** -- See if *most* will do as well or better. Look up "vast.“

- **Myself** -- Not a substitute for me. "This paper has been reviewed by Dr. Smith and myself" and "The report enclosed was prepared by Dr. Jones and myself" are incorrect; *me* would have been correct in all instances. Some **correct** uses of *myself*: I found the error myself. I myself saw it happen. I am not myself today. I cannot convince myself.

- **Partially, partly** -- Compare the meanings (see also *impartially*). *Partly* is the better, simpler, and more precise word when partly is meant.

- **Percent, percentage** -- Not the same; use percent only with a number.

- **Predominate, predominant** -- *Predominate* is a verb. *Predominant* is the adjective; as an adverb, *predominantly* (not "predominately").

- **Prefixes** -- (mid, non, pre, pro, re, semi, un, etc.) -- Usually not hyphened in U.S. usage except before a proper name (pro-Iowa) or numerals (mid-60s) or when lack of a hyphen makes a word ambiguous or awkward. *Preengineered* is better hyphened as *pre-engineered*, one of the few exceptions.

- **Principle, principal** -- They're different; make sure which you mean.

- **Prior to, previous to** -- Use *before, preceding*, or *ahead of*. There are *prior* and *subsequent* events that occur before or after something else, but *prior to* is the same kind of atrocious use that attempts to substitute "subsequent to" for "after.“

- **Proven** -- Although a *proven* adjective, stick to *proved* for the past participle. "A *proven* guilty person must first have been *proved* guilty in court.“

- **Provided, providing** -- *Provided* (usually followed by "that") is the conjunction; *providing* is the participle.

- **Reason why** -- Omit *why* if reason is used as a noun. The reason is...; or, the reason is that... (i.e., the reason **is** the why).

- **Since** -- has a time connotation; use "because" or "inasmuch as" when either is the intended meaning.

- **Small in size, rectangular in shape, blue in color, tenuous in nature, etc.** -- Redundant.

- **That and which** -- Two words that can help, when needed, to make intended meanings and relationships unmistakable. If the clause can be omitted without leaving the modified noun incomplete, use which and enclose the clause within commas or parentheses; otherwise, use *that*. Example: "The lawn mower, *which is* broken, is in the garage." But, "The lawn mower *that is* broken is in the garage; so is the lawn mower *that* works."

- **To be** -- Frequently unnecessary. "The differences were [found] [to be] significant.“

- **Varying** -- Be careful to distinguish from *various* or *differing*. In saying that you used varying amounts or varying conditions, you are implying **individually changing** amounts or conditions rather than a selection of various or different ones.

- **Where** -- Use when you mean *where*, but not for "in which," "for which," etc.

- **Which is, that were, who are, etc.** -- Often not needed. For "the site, which is located near Ames," try "the site, located near Ames" or "the site, near Ames." Rephrasing sometimes can help. Instead of "a survey, which was conducted in 1974" or "a survey conducted in 1974," try "a 1974 survey."

- **Beware of misplaced or dangling modifiers and pronoun antecedent problems.**

- The difficulty here is that you, as the author, know exactly to which each has reference even though not explicitly stated. Your reader, however, doesn't have this advantage, and the result may be confusing, misleading, or funny.

- **EXAMPLES**:

- *"Using multiple-regression techniques, the animals* in Experiment I were...„

- *"In assessing the damage, the plants* exhibited numerous lesions."

- "The *spiders* were inadvertently discovered *while repairing a faulty growth chamber."*

- **Ambiguous pronoun antecedents**

- "All samples in Lot II were discarded when *the authors* found that *they* were contaminated with alcohol, rendering *them* unstable." [and unable to think clearly?]

- "The guidelines were submitted to *the deans*, but *they* subsequently were ignored."

- **Language Issues – Summary/Conclusion**

- Be more or less specific
- Avoid clichés like the plague. They're old hat.
- Verbs has to agree with their subjects.
- Prepositions are not words to end sentences with.
- And don't start a sentence with a conjunction
- It is wrong to ever split an infinitive.
- Parenthetical remarks (however relevant) are (usually) unnecessary.
- Also, never, ever use repetitive redundancies.
- No sentence fragments.
- Contractions aren't good style and shouldn't be used in formal writing.
- Do not be redundant; do not use more words than necessary.
- One should never generalize.
- One-word sentences? Eliminate.
- Eliminate commas, that are, not necessary.
- Never use a big word when a diminutive one would suffice.

- **Language Issues – Summary/Conclusion**

- Kill all exclamation points !!!
- Use words correctly, irregardless how others use them.
- Understatement is always the absolutely best way to put forth earth-shaking ideas.
- Use the apostrophe in it‘s proper place and omit it when ist not needed.
- Who needs rhetorical questions?

- <u>Finally:</u>
- Proofread carefully to see if you any words out.

2. Technicalities

Typesetting

- **WYSIWYG (What You See Is What You Get)**
  - Microsoft Word - versatile commercial document composing tool. Nevertheless it does have 1 very important inherent drawback: equations quality.
  - OpenOffice.org - ...

- **WYSIWYM (What You See Is What You Mean)**
  - LaTeX - a macro package around TeX, which is a typesetting system capable of providing truly high-quality material of any kind

- **Reference management software**

- Reference management software, citation management software or personal bibliographic management software is software for authors to use for recording and utilising bibliographic citations (references). Once a citation has been recorded, it can be used time and again in generating bibliographies, such as lists of references in articles.

- These software packages normally consist of a database in which full bibliographic references can be entered, plus a system for generating selective lists or articles in the different formats required by publishers and learned journals. Modern reference management packages can usually be integrated with word processors so that a reference list in the appropriate format is produced automatically as an article is written, reducing the risk that a cited source is not included in the reference list.

- Examples: Endnote, BibTeX ;
- Internet source for literature: ISI/Web of Science

- **Graphics software**

- http://en.wikipedia.org/wiki/Scientific_writing

- **Computer algebra systems**
- **Numerical software**
- **Plotting programs (graphing programs)**
- **Statistical software**

- **Practice of writing research papers**

- http://www.dentistry.leeds.ac.uk/elective/WRITE%20UP.htm

- **Writing a research paper**

- **General points:**

- Give yourself enough time to work. Remember that writing is a process. A good paper doesn't come out perfect first time for anyone. Even the best scientists have to struggle to organize their papers and everyone, including you, needs to go through several revisions before they reach the final product!

- The quality of the writing reflects the quality of the research! Use clear, direct prose. Make every word count. Don't use extra words, or excessively long words when shorter ones will do. Write as you would speak.

- Find a good (?) paper from a respected journal and use it as a model for your own writing.

- Start with an outline of the paper sketching out what's going to go in the introduction etc. Use subtopics and subject sentences to build your outline.

- Then write a rough draft that includes the main ideas and fleshes out your topic sentences into paragraphs in rough form (don't worry about details like exact references, full sentences etc at this point).

- Use the active voice when possible. There is a trend in scientific publishing toward writing "I measured 50ml..." rather than "50ml was measured". The active voice is usually less wordy and more interesting to read.

- Once you have finished with your rough draft, take a break before rereading your paper. Then start to fiddle with the details (cleaning up the prose etc)..

- Let a friend or colleague read your draft. Listen to what they say.

- Write your second draft.

- Spell check and check the grammar carefully. Make sure the ideas are outlined clearly and flow logically within the text.

- Publish! (better: submit!)

- **Check before submission that you:**

- Numbered the text pages consecutively, beginning with the first or title page.

- Numbered your tables (typed separately from the text, not more than one on a page) consecutively in the order in which you want them to appear.

- Read the title and headings of each table objectively to determine whether the table can be understood without reference to the text

- Searched the text for references to tables to make certain that each table is referred to and that each of the references is to the appropriate table.

- Indicated by a marginal note a place for each table.
- Examined your text, tables and legends to make certain that each reference cited is accurately represented in the reference list.
- Examined your reference list to make certain that each work listed there is accurately referred to in the text, tables or legends.
- Examined each item in the bibliography section for accuracy of dates, wording, spelling and other details.
- Prepared adequate legends for all illustrations (double-spaced on a separate page)

- Made certain that illustrations are numbered consecutively in the order in which you want them to appear in your article, that each of them is referred to at least once in the text, and that each reference is to the appropriate illustration.

- Indicated by a marginal note a place for the figure.

- Reconsidered the appropriateness of your title and abstract and your index terms (if any).

- Reviewed the special requirements of the journal to which you are submitting your manuscript and made certain that you have met them.

- Carefully read your final typescript at least twice, the second time preferably on a different day.

- In case of submission by mail: prepared as many copies of your text, tables and illustrations as are required.
- or
- In case of online submission: prepared the files according to the instructions for authors, and provided the software you have used.
- Kept for your files a complete copy of your manuscript and accompanying material.
- Enclosed copies of releases for material requiring releases.
- Included on the first page of the typescript the address to which letters, proofs and requests for reprints should be sent.

Note:

nowadays, tables and figures are usually inserted in the
(electronic) manuscript at appropriate positions,
with captions included. Refer to “author instructions“ in case!

- **Letter to the editor**

- **Example (AE):**

Dear Professor ….:

Please find enclosed our manuscript *“Cluster Formation and Rheology of Photoreactive Nanoparticles”*.

We studied *the cluster formation of photoreactive nanoparticles upon irradiation, and the effect of this process on the rheological behavior of dilute colloidal dispersions*.

Since our work should be of interest to many readers of ……., we have decided to submit our paper to your journal, hoping you will find it acceptable for publication.

Sincerely

……

- **Ethical Policy**

- **From:**
- **“Best Practice Guidelines on Publication Ethics: A Publisher‘s Perspective“**
- Wiley-Blackwell

- see www.BlackwellPublishing.com/PublicationEthics

- Authors must disclose all sources of funding for their research and its publication.

- Authors must disclose relevant competing interests (both financial and personal)

- Credit for authorship should be based on:

✓ - substantial contributions to research design, or the acquisition, analysis or interpretation of the data

✓ - drafting the paper or revising it critically

✓ - approval of the submitted and final version

✓ Authors should meet all three criteria.

- Authors must acknowledge individuals who do not qualify as authors but who contributed to the research

- Authors must acknowledge any assistance they have received (e.g. provision of writing assistance, literature searching, data analysis, administrative support, supply of materials). If/how this assistance was funded should be described and included with other funding informations.

- **The copyright form (see journals webpages)**

- Authors must declare that the submitted work is their own and that copyright has not been breached in seeking its publication.

- Authors should declare that the submitted work has not previously been published in full, and is not being considered for publication elsewhere.

- Authors of manuscripts describing experiments involving human participants must give assurances that appropriate consent was obtained.

- Authors of manuscripts describing experiments involving animals must give assurances that appropriate methods were used to minimize animal suffering.

- **For further instructions:**

  see “guideline for authors“ on journals webpages

- **Responding to the editor:**

- **Acceptance without revision**
- You need take no further action untile the proofs reach you, except prehaps write a note thanking the editor.

- **Minor revisions requested ("accepted")**
- Consider the suggestions carefully, and if you agree that they will improve the paper, modify or rewrite sentences or sections as necessary. Retype any heavily corrected pages before you return the paper to the editor, but enclose the original corrected paper as well as the retyped copies. In your covering letter sent with the revised version, thank the editor and referees for their help and enclose a list of the substantial changes made in response to their suggestions; if you have rejected one or more of the recommendations, explain why.

- **Major revisions requested ("further consideration")**
- You will have to think hard if the effort is worth while. You may eventually decide that the paper is better as it is, and proceed to try another editor (another journal) in the hope that he will agree with you.

- **Rejection**
- If the editor says the article is too specialized or outside the scope of the journal, your best course is to send it to another journal, first modifying the style to comply with the instructions of that journal.
- If the article is rejected because is is said to be too long and in need of changes, consider shortening and modifying it according to the criticism – and then submit it to a different journal (if the editor had wanted to see a shorter version he would have offered to reconsider it after revision!).

- **Rejection (continued)**
- If the editor thinks the findings reported are unsound or that the evidence is incomplete, put the paper aside until you have obtained more and better information, unless you are sure that the editor and his advisers are wrong.

- Consider contesting the decision only if you honestly think, after considerable reflection and at least one night‘s sleep, that the editor and referees have made a superficial or wrong judgement. In this case write a polite letter explaining as briefly as possible why you think the editor should reconsider his decision.

Summary: Steps in writing a paper

- Assess your work: decide what, when and where to publish. Refrain from duplicate publication, and define your purpose in publishing.
- Obtain and read the Instructions to Authors of the journal chosen
- Decide who the authors will be
- Draft a working title and abstract
- Decide on the basic form of the paper
- Collect the material under the major headings chosen

Steps in writing a paper - continued

- Design tables, including their titles and footnotes; design or select illustrations and write titles and legends for them
- Write for permission to reproduce any previously published tables, illustrations or other material that will be used
- Write a topic outline and perhaps a sentence outline
- Write, type or dictate a preliminary draft of the text quickly (!), to give it unity.
- Check completeness of the references assembled
- Put the manuscript or typescript away for a few days

Steps in writing a paper - continued

- Re-examine the structure of the paper
- Check the illustrations and tables and make the final versions
- Re-read the references you cite and check your own accuracy in citing them; check for consistency, and reduce the number of abbreviations and footnotes
- (Re)type the paper (= first draft)
- Correct the grammar and polish the style
- Type several copies of the corrected paper (= second draft)

Steps in writing a paper - continued

- Ask for criticism from co-authors and friends
- Make any necessary alterations
- Compose a now title and abstract suitable for information retrieval, list the index terms and assemble the manuscript
- Compile the reference list, cross-check references against the text, and ensure that all bibliographical details are correct
- Retype (= penultimate version) and check typescript
- Obtain a final critical review from a senior colleague
- Make any final corrections (final version)

Steps in writing a paper - continued

- Write a covering letter to the editor, enclosing copies of letters giving you permission to reproduce any previously published material or to cite unpublished work

- Check that all parts of the paper are present, and post as many copies as specified to the editor

- If the editor returns the paper, revise it as necessary, send it elsewhere, or abandon it

- Correct the proofs

- **Scientific ranking of journals – the impact factor**

- **From:**
  http://www.sciencegateway.org/rank/index.html

Journals Ranked by Impact: Mater.Sci.

Rank	2007 Impact Factor	Impact 2003-07	Impact 1981-2007
1	Prog. Mater. Sci. (20.85)	Nature Materials (37.04)	Mat. Sci. Eng. R (69.87)
2	Nature Materials (19.78)	Mat. Sci. Eng. R (31.54)	Prog. Mater. Sci. (65.57)
3	Nature Nanotechnol. (14.96)	Ann. Rev. Mater. Res. (18.77)	Ann. Rev. Mater. Sci. (49.05)
4	Mat. Sci. Eng. R (14.40)	Prog. Mater. Sci. (17.76)	Int. Mater. Reviews (40.38)
5	Nano Letters (9.63)	Nano Letters (17.48)	Nature Materials (37.04)
6	Advanced Materials (8.19)	Advanced Materials (16.28)	CR Solid St. Mater. Sci. (32.83)
7	Adv. Funct. Mater. (7.50)	CR Solid St. Mater. Sci. (12.48)	Advanced Materials (32.36)
8	Small (6.41)	Adv. Funct. Mater. (10.53)	Acta Metall. Mater. (26.54)
9	MRS Bulletin (5.17)	Curr. Op. Sol. St. Mat. (9.71)	Ann. Rev. Mater. Res. (25.61)
10	Chem. Materials (4.88)	Chem. Materials (9.63)	J. Mech. Phys. Solids (23.45)

Impact Factors

The Ten Most-Cited Journals of 2006
Ranked by total citations tallied in 2006 (the most recent year covered by Thomson Scientific Journal Citation Reports) to previously published articles in each journal.

Rank	Journal	Citations in 2006	Rank for 2005
1	Journal of Biological Chemistry	410,903	1
2	Nature	390,690	2
3	Proc. Natl. Acad. Sci. USA (PNAS)	371,057	3
4	Science	361,389	4
5	J. American Chemical Society	275,769	5
6	Physical Review Letters	268,454	6
7	Physical Review B	212,714	7
8	New England Journal of Medicine	177,505	8
9	Astrophysical Journal	162,136	9
10	Journal of Chemical Physics	157,334	10

Science Output – Top Ten Countries

Rank	Country	Papers 1998-2008
1	United States	2,798,448
2	Japan	757,586
3	Germany	723,804
4	England	641,768
5	France	517,096
6	People's Republic of China	511,216
7	Canada	388,471
8	Italy	370,053
9	Spain	271,753
10	Russia	262,982

SOURCE: *Essential Science Indicators*SM from Thomson Reuters

Science Impact – Top Ten Countries

Rank	Country	Papers 1993-2003	Avg. citations per paper
1	Switzerland	142,982	13.24
2	United States	2,799,593	12.63
3	Netherlands	202,184	11.33
4	Denmark	79,929	11.14
5	Sweden	158,136	10.85
6	Scotland	96,571	10.75
7	England	619,707	10.74
8	Canada	370,928	10.25
9	Finland	74,106	10.17
10	Belgium	103,181	9.74

SOURCE: *Essential Science Indicators*[SM] from Thomson Reuters
The top ten countries ranked according to average citations per paper in all fields (that is, 22 main subject areas, (including general social sciences))

The end

- **Questions/comments ???**

- **Next:**
- 1. Present your own figures (evtl. with captions)

- 2. “Write a paper (first draft)“ based on selected sets of **figures with figure captions**
  (**title**, **abstract**, (introduction), (materials/methods), (results and discussion), **conclusions**)