Los Medanos College
Center for Academic Support
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Writing in the Sciences

What this handout is about...

The Writing Center intends this handout to help those writing scientific papers:

1) recognize the conventions that shape scientific writing style

2) understand why these conventions exist

Once you comprehend the nature of a community of writers, you also begin to appreciate that stylistic conventions are not merely arbitrary "rules" designed to complicate our lives. Instead of just laying out a lot of dos and don'ts, this handout will try to explain the rationale behind the writing decisions you'll be facing.

What is scientific writing?

When do people write in the sciences? What different types of writing exist in the sciences? Who reads this writing? Why? What identifies a piece of writing as scientific? Such questions help to complicate the general idea of scientific writing, and complication is (believe it or not) helpful here. Depending on your background, you may associate scientific writing strictly with the lab report. Introduction, materials and methods, results, discussion--all that jazz. This description of scientific writing is, however, extremely limited. Sure, the lab report forms the basis for most professional scientific communication; it's the customary way for a group of researchers to share their findings with others in the field. Yet other, very distinct opportunities for writing do exist:

- the review article, designed to provide an introduction to previous research on a subject; ·
- the peer review, which gives feedback to fellow writers;
- the annotated bibliography, a tool to aid others in performing research;
- the descriptive essay, which experts sometimes use to explain events, principles, or phenomena to non-scientists;
- the abstract, usually but not always preceding a longer article, which summarizes an experiment or study;

- the grant proposal, which justifies the value of a prospective or ongoing research project.

Each of these writing situations has its own conventions, but they do tend to employ similar writing styles. Moreover, although you may believe that scientific writing doesn't really have a style (a belief that may even have heightened the discipline's attraction for you), readers do notice stylistic issues and will judge your work accordingly. In other words, even though your response to an assignment seems to cover all the bases, your instructor may not recognize your command of the material if you don't sound as though you have this command.

What factors shape the scientific writing style?

In science writing, both writers and readers abide by the scientific method, the central principle of the discipline. Using the scientific method, we develop a hypothesis based on previous experience and/or initial observations, devise some method to test that hypothesis, and compare the results we obtained to the ones we expected. If the results don't support our hypothesis, we modify the hypothesis (or perhaps the test) to try to account for the difference, and begin the process all over again. This information is pretty basic for even the least experienced science student, but it helps illustrate the values scientists hold.

If the test is to be useful to others, we must be sure to remain objective, because we're trying to establish a model that will always be valid. We must be precise, because our evaluation of the results of an experiment depends upon our ability to state them as exactly as possible. We must be logical, because we have to explain why: why we thought our hypothesis might be valid, why we performed the test the way we did, why we interpreted the results the way we did, and so on. We must be careful, because we don't want to leap to an unjustified conclusion; it's better to discard a hypothesis than to stretch our findings to meet it. Most importantly, perhaps, we must be clear, because our ideas are worth nothing if our readers don't understand them.

Most of us recognize that these are useful values to apply to scientific work, but it's sometimes hard to see how they show up in scientific writing. Below, we'll discuss how you can show through your writing that you subscribe to the same principles as your readers.

How can I make my writing more objective?

- Avoid first person ("I" or "we"), because it shouldn't matter what you think or do as an individual. In an experimental study, for example, readers should ideally be

able to duplicate the conditions of the experiment. If it's important that you performed the procedure, as first person narrative would indicate ("We observed the color change"), then no one else can reasonably hope to re-create these conditions--you won't be there. Similarly, your evidence should warrant your conclusions, so your writing should emphasize the more or less universal applicability of your discussion. As such, remember that you should be explaining how the data leads to specific conclusions, not what you think or believe based on these results;

- How many times have you been told not to use passive voice? Well, science readers often expect you to use passive constructions. If you're unsure what we mean by passive voice, you might check out our handout on writing style. Basically, "passive" means that the grammatical subject of the sentence does not perform the action described by the verb. For example, if you went outside after a visit to the salon and got caught in a downpour, you might say, in passive voice, "My new hairstyle was ruined by the rain," whereas in active voice you would say, "The rain ruined my new hairstyle." Notice that in the former, "hairstyle" is the subject of the sentence, but "rain" did the ruining. For the same reason that science writing tends not to use first person, readers will generally prefer that you use passive voice to describe what you did (in an experiment, say), because the steps in the experiment are more important than the fact that you performed them. Not "We interviewed thirty subjects," then, but "Thirty subjects were interviewed";

- Avoid trying to be creative in the language you use, especially if that creativity causes you to deviate from the standard format. Figurative language ("the subject group suffered from a sea of psychological disorders," or "the solution turned blood-red") is especially unwelcome. Robert A. Day writes that compared to literature, "the communication of research results is a more prosaic procedure . . . demand[ing] a system of reporting data that is uniform, concise, and readily understandable" (12). Any stylistic feature that interferes with the presentation of findings renders these findings untrustworthy to many readers, and figurative language belongs to this category.

- Avoid qualitative assessments (such as believable, fortunate, useful, etc.) whenever possible, since you and your reader will often disagree about the applicability of such terms. Two notes in particular for those new to writing lab reports: 1) whether something is interesting or not is almost never relevant to your reader, and in any case "interesting" denotes a personal response; 2) it is not for you to determine whether your experiment was "successful" or "unsuccessful"--we can always learn from experiments that don't produce the expected result, and the scientific community measures success by your ability to analyze the results you see.

How can I make my writing more precise?

- Quantify (express as a measure or ratio/percentage) whenever possible, in order to avoid vagueness. Don't rely on subjective categories such as "soon" or "not much." Readers may have entirely different ideas about how much time lag is involved in the term "almost immediately." In order to trust your interpretation, readers will expect you to measure everything. Indeed, it's considered scientific malpractice not to do so. Show your readers how painstaking you are by providing them with all the specifics;

- Include as much detail as possible, as long as it's relevant. This "rule" does not mean that you'll get a better grade if you use your computer to draw up a table that repeats information you've already described very clearly, or take time during the "Materials and Methods" section to account for the manufacturing history of the cuvette you used. Try to put yourself in the position of a reader who is trying to replicate your experiment as exactly as possible. What would you need to know?

How can I make my writing more logical?

- Follow the scientific method (as described above). The reasoning of any scientific investigation is bound up in these principles, and governs both the organization and the development of your ideas. The basic "IMRAD" structure of most lab reports (Introduction, Materials and Methods, Results, and Discussion) originates from the scientific method, and even within these sections you can see these principles at work.

For example, you don't often begin your introduction by launching into your hypothesis; using the scientific method, tell the reader what led you to develop this hypothesis, whether that spur was previous experience, initial observations, or "common sense". Similarly, in the discussion, you might start by stating whether the results you obtained supported the hypothesis, and then move to a more complex consideration of why.

- Ensure that your conclusions, however provisional, are warranted by the evidence you have. Moreover, in most science writing, you should explain very painstakingly exactly how each conclusion is warranted. Although you may believe it to be patently clear that the unusually high temperature in the lab affected the results you obtained, for instance, you still need to explain why and how it did so.

This kind of explanation is probably the hardest aspect of writing within the scientific community, since we almost never defend how our ideas are warranted in

everyday conversation. In this discipline, though, you have to defend ideas that probably will seem quite obvious, and you have to try to anticipate reasonable objections to your interpretation of data. It does get easier with practice, though.

How can I make my writing more careful?

- Avoid absolutes (prove, demonstrate, true, always, never). Remember that the scientific method tells us that what we know is provisional, not absolutely true; we devise models for knowledge--we don't "discover" knowledge. As a result, it's entirely possible that someone else will develop a way to describe the world that's very different from previous ones. Consequently, absolutes tend not to hold up well. The most important hint? You're not trying to prove your hypothesis, you're testing it to see if the results you obtain support your hypothesis.

- Avoid terms suggesting mathematical concepts, e.g. "therefore" or "random." For the reasons above, you're not learning anything approaching mathematical proof, since you're not working within a closed system, as mathematicians do. Your writing should reflect the practical uncertainty involved in making a claim about the way the world works. ("Therefore" suggests proof, as you might remember from geometry class. "Random" doesn't mean "without pattern" to a scientist, but rather--from the *American Heritage Dictionary*--"of or relating to equal probability of selection or occurrence for each member of a group.")

- Aualify or limit claims appropriately. Learn to recognize the fallacy in making sweeping generalizations based on a single lab experiment or survey. Try to see yourself as part of a vast community of scientists, all of whom have hypothesized and tested and measured and analyzed virtually everything you can imagine. Instead of suggesting, for example, that you have inadvertently stumbled upon some evidence that contradicts the existing body of knowledge ("Although previous studies have argued that light has properties both of waves and of pulses as it travels, this experiment showed that light in fact only travels in waves"), try to hedge your claim to demonstrate respect for those who have come before you.

How can I make my writing clearer?

- Making your writing conform to the customary systems of logic is a great start. For other tips, consult our handout on writing style.

- Science writing, as we have seen, requires careful qualification of all claims. As a result, even experienced writers in the field commonly experience two stylistic problems: overuse of prepositional phrases and separation of subject and predicate. Here's how to recognize and eliminate these problems:

1) A **prepositional phrase** functions as an adjective or adverb within a sentence; it begins with a preposition (e.g. in, at, for, on, about, with) and includes the words that follow it. In the sentence, "She stabbed the vampire in the heart with a stake," both the phrase "in the heart" and "with a stake" are prepositional phrases modifying "stabbed."

Stringing many prepositional phrases together in one sentence can make your writing seem static and long-winded, and consequently difficult to follow. Here's an example, from style counselor Joseph M. Williams:

> *"An evaluation of the program by us will encourage increases in efficiency in the servicing of clients."*

Notice how many prepositional phrases occur in this sentence? Williams suggests rewriting the sentence to read,

> *"We will evaluate the program so that we can serve our clients more efficiently."* (51)

The revised sentence changes many of the nouns (which require prepositions to fit them into the sentence) to verbs and adverbs: evaluation and servicing both take verb forms, while efficiency becomes an adverb. Even if you remember that scientific writing discourages the use of first-person, the sentence "The program will be evaluated to serve clients more efficiently" still represents an improvement over the original.

Don't feel that you have to avoid using prepositions altogether--it's probably impossible to do so. If you want to decide whether your writing features this problem, try this technique: take a highlighting pen and mark all the prepositional phrases on one page of your writing. If you see that many of your sentences are composed primarily of prepositional phrases, you might try to revise by changing some nouns into verbs and adverbs, as we did above.

2) The second problem science writers sometimes encounter is the separation of the subject from the predicate in the sentence. Consider the following example:

> *"The design of the experiment, in terms of the establishment of a clear control and the practicability of timing the reactions precisely, although compensations were included to address these factors, was not entirely successful."*

The reader would have to wait a relatively long time to find out the main idea of the sentence--that the design wasn't so hot. To avoid stringing out your idea in this way, try moving the predicate closer to the subject of the sentence.

> *"The design of the experiment was not entirely successful, because of the failure to establish a clear control and time reactions precisely, although compensations were included to address these factors."*

This revision is clearer in part because the predicate ("was not entirely successful") occurs almost immediately after the subject ("the design").

References:

Below are some handbooks on scientific writing style that we used to develop this handout. You may find some (or all) of them helpful.

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