Writing in the Sciences

The basic principles of good writing apply just as well to the sciences as they do to the humanities and the social sciences. A science paper should be written in a clear and concise style, its paragraphs should be coherent, and its ideas should be well organized. This handout focuses on the features of science writing that *distinguish* it from other, non-scientific genres. Since some of these features may vary from subject to subject, it focuses on those principles and conventions that are common to most areas of science. Understanding how the distinctive features of science writing reflect the activities and goals of science will help you become a more proficient writer of scientific prose.

Audience

All writers should be aware of their audience. But science writers need to be particularly aware because readers of science-related writing can have very different levels of knowledge. The key question to ask is always, Am I writing for fellow scientists or for a general audience? What your readers know or do not know will have a significant effect on both substance and style.

Titles

Titles in humanities and social science papers are, as a rule, sentence fragments. In science papers they can be either fragments or full sentences, though usually they are fragments:

> The risk of lymphoma development in autoimmune diseases: a meta-analysis

A full-sentence title is good at highlighting one central result:

> Brain natriuretic peptide is a potentially useful screening tool for the detection of cardiovascular disease in patients with rheumatoid arthritis.

As this example illustrates, titles in the sciences can be long. Do your best to make sure that every word counts. Be concrete, but avoid excessive detail.

Some titles are framed as questions, which can succinctly identify just what the authors aim to discover:

> Are there schizophrenics for whom drugs may be unnecessary or contraindicated?

Headings

If you write a humanities essay in university, you will not be encouraged to use headings. The opposite will be true of your science papers. Headings emphasize the systematic nature of scientific enquiry. They also provide an excellent organizational tool, often relieving you of the need to create smooth transitions between the main parts of your paper. Take advantage of them!

In some scientific genres, the sections and heading names are predetermined. For example, scientific studies as well as lab reports are typically divided into the following sections: Abstract, Introduction, Methods, Results, Discussion. The list may vary slightly according to the discipline, the course, or the journal. For complicated experiments, you may subdivide sections into subsections, each with its own subheading.

Headings are not always obligatory. In shorter papers, they may sometimes prove more of a hindrance than a help. Use them only if you find they help you better organize the material.

Jargon

The word *jargon* generally refers to language that is unrecognizable to most people, either because it is deliberately obscure and needlessly difficult, or because it forms part of the technical terminology common to a discipline. The first type of jargon should be avoided whatever discipline you are writing in. It can sound pretentious, and it obscures meaning. The second type of jargon does not carry the same negative connotation. In the sciences, and sometimes in other disciplines as well, this technical language can be indispensable. Consider the following passage from a fourth-year geology paper on competing theories about the extinction of the dinosaurs:

> The **cretaceous** period was a time of great change for land plants. It is thought to have seen the origin of the **angiosperms**, which exploded in diversity and prominence through the period. It was also a period which saw large numbers of extinctions. These are extremely well documented in the fossil record of marine organisms, and less so for land plants. At or near the end of the cretaceous period, groups such as dinosaurs, **belemnites**, **rudist bivalves**, **ammonites**, and many others went extinct.

The intended audience for this paper consists of fellow geologists. The writer can thus count on her readers to know what each of the technical terms means. She does not use jargon here to make her writing sound sophisticated; outside of the scientific terms, the language is simple. The main function of such jargon is compression. The dictionary definition of each of these terms is two or three lines long. If the paper had provided definitions, it would have been considerably longer, and the flow of the argument would have suffered.

Science writing commonly relies on a further form of compression: replacing frequently used terms consisting of more than one word with an abbreviation, typically formed from the term's initial letters. The convention is to specify the abbreviation in parentheses immediately after the first use of the term:

> The incidence of acute otitis media (AOM), one of the most common diagnoses among children, appears to be increasing. Data from the National Ambulatory Medical Care Surveys (NAMCS) indicate that the number of office visits for otitis media increased more than twofold from 1975 to 1990. Although the NAMCS does not differentiate between AOM and otitis media with effusion, the majority of these cases are believed to represent AOM. (*Pediatrics* 108:239)

If you are writing about science for non-scientists, you can still rely on jargon to achieve compression, but you should at least let your reader know what any uncommon term means the first time around. Try to avoid abbreviations, however, unless they are commonly used (e.g., AIDS for Acquired Immune Deficiency Syndrome).

Sometimes you may think jargon is necessary in your science writing when it is not. Rather than achieving concision, such jargon will usually make your prose long-winded and even impenetrable. Is there any good reason for a sentence like the following?

> Members of the medical establishment are not presently cognizant of efficacious treatments resulting in the complete elimination of symptomatology in acute viral nasopharyngitis.

Why not simply say this?

> There is no known cure for the common cold.

Always ask if there is a simpler, more transparent way of making a point.

At the same time, train yourself to read critically the language in *published* scientific work. If some of the sentences leave you confused, then the science may be intrinsically difficult, the writing may be weak, the ideas themselves may be confused, or the writer may be trying to gloss over something. Unraveling an unclear sentence can sometimes provide important insight into the problems with someone else's argument. Moreover, developing your critical reading skills will help you to grow as a writer.

Passive versus Active Voice

In humanities and many social science papers, students should try to use active voice whenever possible. But historically the sciences have often encouraged the use of passive voice. There's a reason for this tradition. Passive voice helps emphasize the objectivity of the sciences:

> The element radon was discovered in 1900.

This stress on objectivity makes especially good sense in the context of a lab report: after all, the experiment is not about you but about what you *did*.

Nevertheless, in the past several years there has been a movement in the sciences away from the passive voice. One reason for this is a philosophical shift in our thinking about science: we are more ready to acknowledge the role of the observer or investigator in the shaping of knowledge. In fact, many journals editors have responded to a growing demand for greater transparency in science by requiring that published scientific papers clearly identify the role and the source of funding of each contributor. Active voice does a much better job of emphasizing agency—the idea that every action has an actor. The other good reason behind this growing preference for active voice is stylistic: often passive voice is simply more awkward, less direct, and less clear.

Learn some simple sentence patterns that will help your writing benefit fully from the directness of active voice. For example, refer to figures, tables, and equations at the beginning of the sentence rather than at the end.

> Figure 1 illustrates the quadratic relationship between distance and velocity.

Do the same with words and phrases such as “results,” “studies”, and “evidence”:

> Experimental evidence shows that the typical dose-response curve has an inverted J-shape.

If you are referring to a technique or procedure, you can also achieve greater directness by making it the subject of your sentence:

> PCR analysis produced clones of the toxin B DNA originally isolated in cultures of C. difficile from hospital patients.

And even though your course instructor may dissuade you from using “I” or “we,” do not shy away from placing other scientists in the subject position:

> Peto provided a detailed description of the logrank test in his 1977 article on the use of survival analysis in long-term randomized trials.

Note that even the use of the first-person pronouns, “I” and “we,” is becoming more acceptable in scientific discourse. Course instructors, TAs, and journal editors may all take different positions on this question. The only way to be sure is to ask. When “I” or “we” is not allowed, the passive voice is sometimes unavoidable.

Even in disciplines where both active voice and first-person pronouns are acceptable, the rules may be different for lab reports, at least for the Methods section. Lab instructors in some disciplines still insist on passive voice (in past tense) throughout that section: in other words, they do not accept any active constructions, even if you avoid using “I” and “we.” But a growing number of courses have followed the lead of journals by accepting first-person active constructions even in the Methods section. If you’re writing a lab report and you’re not sure of the rules, consult your lab manual or your TA. Whatever the rules for your course, be careful to comply. But remember that such rules usually apply only to the Methods section. Don’t let the habits you cultivate for that specific part of a lab report hamper you unnecessarily in the rest of your science writing.

Tense

The two most common tenses in science papers are present and past. Future and present perfect rank a distant third and fourth.

Use present tense when you are making assertions about nature or about concepts:

> Turtles are bigger than beetles.

Use past tense when you are describing what you or someone else did or asserted:

> Darwin observed the difference in adaptability between turtles and beetles.

Use future tense when you lay out your plan in a proposal:

> In my final project, I will compare survival strategies in turtles and beetles.

Note that the use of first-person singular is often appropriate in a proposal.

Use present perfect when you are describing what you have done repeatedly in the past continuing up to the present:

> Over the past several months I have collected data on turtles and beetles.

Observe that we can mix tenses in a single sentence, and indeed we often need to:

> Darwin observed that beetles are more adaptable than turtles.

The use of past tense in describing someone else's work is one key difference between science and the humanities. In the humanities, when we are describing what a writer, an artist, or a scholar asserted, we think of ourselves as engaging in a conversation that takes place in the eternal present:

> Shakespeare compares the poet's lover to a summer's day.

The one exception would be when the emphasis is on history, in which case the past tense is called for:

> Shakespeare wrote many of his tragedies during a period of great political instability.

The sciences see the contribution of any individual as adding progressively to an ordered sequence of investigations. The past tense helps convey a sense of this temporal progression.

Sources

The practices in the sciences for integrating sources into one's own work differ from practices in the humanities. Science writing, particularly report writing, relies largely on summary, which involves conveying only the key points from someone else's work. Scientists do not generally rely on direct quotation, and this is especially true of report writing. Paraphrase can also occur, when the analysis of someone else's work requires close attention to detail, and it can be an important tool in more discursive forms of science writing than reports. For example, a critique of the way eugenicists adapted Darwinian ideas in the last four decades of the nineteenth century might involving paraphrasing and closely analyzing specific passages in the works of influential eugenic theorists from that period.

The conventions for citing sources also differ in the sciences. Science courses rely increasingly on the citation-sequence system of referencing. The details may differ slightly depending on your discipline, but generally you list references on a separate page at the end of the paper in numerical sequence according to the order in which sources are cited in the paper, rather than in alphabetical order. In the body, you insert the reference number in the appropriate place (within parentheses or as a superscript), repeating a previous number if you have already cited the same source earlier. The citation-sequence system minimizes clutter and allows readers to find references quickly.

Some science courses rely on the name-year system. Like the APA system commonly used in the social sciences, this system lists sources alphabetically and places a greater emphasis on dates than the citation-sequence and the MLA systems do. Though less streamlined than the citation-sequence system, the name-year system offers two advantages: it produces more easily searchable and therefore more useful reference lists, and it lets the reader know in the body of the paper when studies were performed.

Check with your TA or your course handbook to find out what your course requires.
