



Writing in the Sciences¹

Scientific writing follows certain conventions related to format, citation, design, voice, tense, concision and organization that may differ from writing in other contexts. Although every audience—be it a peer-reviewed journal, professional organization, or academic search committee—has unique expectations and demands, the following advice applies to most scientific writing.

Present and organize information in the correct format:

Readers expect information in a certain order under specified headings

- Most article manuscripts and theses follow the IMRaD format
 - Introduction, Methodology, Results and Discussion
 - Some documents contain a Literature Review after the Introduction
- Reports, proposals and memos use a much different organizational logic
 - Policy Recommendation Memos, for example, state all recommendations in the first paragraph, followed by rationale paragraphs, a Case Summary, often a Feasibility section, etc.

Use the correct citation style:

Though many journals maintain modified systems of citation and reference, most scientific writing follows one of three citation styles:

- AMA (American Medical Association)
- APA (American Psychological Association)
- CSE (Council of Science Editors)

Use direct quotations sparingly:

- Paraphrasing demonstrates comprehension of source material and the ability to concisely synthesize it with one's own ideas
- Direct quotations should only be used when meaning might be lost by paraphrasing the original author's words

Use tables, graphs and other visuals to illustrate information:

- Visual aids can sometimes illustrate information more clearly than sentences and paragraphs
- Each citation style has its own conventions for labeling and referencing visual aids

Write in active voice unless passive voice is necessary:

Active voice is generally more effective in scientific writing

- It is direct and clear
- It demonstrates agency



Passive voice is sometimes preferable

- When the action itself is more important than who performed the action
 - In methodology sections, for instance, passive voice removes the agent and makes the experimental process the subject of the sentence

In the following example, active voice is preferable because it may be important to know who drew or what determined the conclusion:

- *Passive Voice*: It was concluded that the river is contaminated.
- *Active Voice*: Researchers concluded that the river is contaminated.
Results demonstrate that the river is contaminated.

In the next example, passive voice is preferred because the action is more important than who performed the action.

- *Active Voice*: We observed cell division in the sample.
- *Passive Voice*: Cell division was observed in the sample.

Write in the proper tense:

Use *past tense* for actions performed in the past, including primary and secondary research/source material and most methodology descriptions

- Jones et al. **discussed** a small yet significant difference...
- Mothers **were interviewed** in early and late pregnancy...

Use *present tense* for statements of fact, general truths, and conditions that are continuously true. When writing about others' completed research or published findings, generally use past tense; however, if the views of a current researcher are well known and commonly accepted as fact, present tense may be preferred.

- Researchers **recognize** that folic acid supplements are a potent source of methyl donors, which can **induce** epigenetic changes by altering...

Use *present perfect tense* to describe action or research that occurred in the past but that is ongoing or connected to the present.

- No previous study **has** reported the simultaneous effect of...

Eliminating Redundancy:

Scientific writing requires a writer to convey complex information directly and concisely. Add all the detail needed to convey the idea, but leave out extraneous information. Write concisely and omit redundancy by:

- Using precise action verbs
- Avoiding hedging verbs such as appear and seem and useless qualifiers such as perhaps, very, quite, several, essentially, basically, always and actually
- Limiting the use of prepositional phrases



Example:

Wordy: In the first trial conducted in this experiment, there appears to be a demonstration of the effects when the substances are combined into one.

Concise: The first trial demonstrated the negative effects of combining the substances.

Note that the prepositional phrases “in the first trial” and “in this experiment” have been eliminated, and “the first trial” becomes the subject of the sentence. The revised sentence avoids the hedging verb “appear” in favor of the more active “demonstrated,” and since “combined” implies that two things become one, the phrase “into one” is omitted. “The negative effects” becomes the object of the sentence, leaving only one prepositional phrase at the end: “of combining the substances.”

Make sentences simple and active:

Writers in the sciences often overcomplicate their explanations with nominalizations. This should be avoided because scientific concepts are already complex and can easily be obfuscated. Because verbs are the strongest, most active component of a sentence, such confusion often stems from the nominalization of verbs: when the verb becomes a noun, which buries the action and weakens the verb. Consequently, the sentence becomes more difficult to understand. An example of this is:

Nominalization: An **analysis** of the prefrontal cortex shows the patient’s inadequate emotional and behavioral **regulation**.

Revision with Active Verb: The researchers **analyzed** the patient’s prefrontal cortex and found that he inadequately **regulated** his emotions and behavior.

In the first example, the subject is “analysis,” but this could function as a stronger action verb: “analyze.” Changing “analysis” from a noun to a verb allows for a clearer subject: “the researchers.” By changing “regulation” to a verb, it is easier to identify the phenomenon the researchers observed in the patient.

Build arguments by connecting sentences:

Scientific writing makes an argument, whether you’re synthesizing previous research, arguing for a new method, or making a case for the validity of your own conclusions. These arguments are clearer when sentences build off each other. Since readers focus on concepts at the end of sentences, it is important to begin subsequent sentences by building on preceding ideas and enacting the idea of end focus. It is helpful to think about this concept in terms of known information and new information. Experienced writers begin sentences with information that is already known or has previously been introduced; they utilize end focus by concluding



sentences with new information because this is where the reader typically expects novel and important information. Following this pattern forges a clear connection between sentences and provides readers with a logical progression of ideas.

- *Unclear:* **Intramembranous bones**, in the cranium, are ossified from membranes transformed from mesenchymal tissues. The cranial vault, facial bones, the mandible, and the clavicle are **intramembranous bones**.
 - These sentences are disjointed. The old information in the second sentence is placed in the stress position (at the end of the sentence), and the new information is placed at the beginning of the sentence, in the topic position. As a result, the sentences are not coherent.
- *Clear:* Some areas of the cranium are ossified from membranes transformed from mesenchymal tissues and are **called intramembranous bones**. **These bones** include the cranial vault, facial bones, the mandible, and the clavicle.
 - These sentences are coherent because the old information is placed at the beginning of the second sentence and the new information is placed at the end (the stress position). The new information in the first sentence becomes the old information in the second, which helps the reader follow the ideas being presented.

Avoid subject-verb separation whenever possible:

Because scientific writing often builds off other concepts and theories across fields, it is particularly useful to keep the subject and verb close together to make it easier for layreaders to follow. Keeping subjects and their verbs connected (especially in longer sentences) ensures that readers don't forget who or what is performing the action:

- *Unclear:* **DNA**, found in body fluids (blood, saliva, urine, and semen), soft tissues, bone, teeth, nails, hair roots (nuclear DNA), and hair shafts (mitochondrial DNA), **contains** genetic code.
- *Clear:* **DNA contains** genetic code and is found in body fluids (blood, saliva, urine, and semen), soft tissues, bone, teeth, nails, hair roots (nuclear DNA), and hair shafts (mitochondrial DNA).

In this example, the revision is much easier to follow because the reader is immediately able to identify the subject (DNA) and what the author wants to say about it (that it contains genetic code and where it is found in the body). Consequently, the reader is not bogged down in an extensive list of examples before understanding what the author aims to convey.

References

1. The Writing Center at CU Denver. Principles of scientific writing. 2015.