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Tips for Effective Scientific Writing

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1. Write in paragraphs that build coherent blocks of thought. Each paragraph should provide logical arguments that support a statement or idea. The statement or idea you are describing or defending should be clearly worded in a topic sentence, which is best placed at the beginning of the paragraph. Notice that the first topic sentence in this paragraph is very simple, and the remaining sentences all describe or support the first statement.

2. Use short declarative sentences and avoid flowery or unnecessary expressions. Examples of unnecessary **expressions to avoid** are:
   In order to; It is shown that; It can be noticed that; It has to be mentioned that; It should however be noted that; It is clear that; Regarding this fact that; It is given by the fact; Based on our experiments/understanding; As can be seen from Figure (table); It takes into account the fact that; It is identified that.
   Such expressions can usually be deleted without altering the message.

3. With the possible exception of the experimental section, always **write in the active voice** and not the passive voice. Passive voice (highlighted similarly hereafter) often shows up with the words *was* or *were* and often with verbs ending with *–ing*. In the passive voice, one usually cannot tell who or what is making the action happen. Learn to write in a style where subjects or nouns directly act on other nouns.
   Not: The two solutions were mixed, and a blue color *was observed.*
   But: The reaction mixture *turned* blue.

   Not: A needle valve was used to regulate the pressure.
   But: A needle valve *regulated* the pressure.

   Not: No evidence was found that A caused B.
   But: A *did not cause* B.

4. **Avoid starting sentences with** vague demonstrative pronouns like ***this or it***. Instead, use the actual noun or subject. At an absolute minimum provide a qualifying noun with the pronoun.
   Not: *This* is because the temperature was *higher*. (also contains a forbidden term and lacks a comparison)
   But: *The reaction* proceeded faster at 60 °C than at 50 °C.

   Not: *These* are always found together.
   But: *The two stereoisomers* always occur together.

5. **Use specific qualifiers and quantitative comparisons** instead of vague or subjective comparisons:

   Not: The crystals grew *larger over time* until they were *really big*.
   But: The crystals grew to more than 50 micrometers in diameter in less than five minutes.
   The following terms are vague, weak and subjective, so consider them ***forbidden terms***, unless they are used with additional quantitative qualifiers or context.
   Very, not very, big, small, large, little, nice, good, bad, better, worse, okay, quite, really, got, get, low, high, believe, think, this, that, these, those, it.
   Acceptable: …big difference of 30% (RSD); …small loss of 5%; …good recoveries of 90-110%; low limits of detection of 4 ng/mL; …these differences are…; …this method is…

6. **Avoid** Gerunds, in which verbs are used like nouns, and present participle phrases that use **verbs ending with *–ing*** to modify nouns. Such language is fine in conversations but has high cognitive demands of readers and is generally weak.
   Not: Practitioners can use this model, *accounting* for differences in temperature.
   But: Practitioners can use this model to account for differences in temperature.

   Not: Figure 3 shows a plot of y versus x, *showing* good linear behavior. (also, too vague; a *good* fit for you may be unsatisfactory for me)
   But: Figure 3 is a plot of y versus x. Linear regression provides a good linear fit of r=0.92.

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Not: *Weathering* was accomplished at three different temperatures before *analyzing* the residues on a GC-MS.
But: A GC-MS analyzed the gasoline residues weathered to 27%, 55%, and 85% by volume.

7. **Always have a space between numbers and units**, and use units in a manner consistent with IUPAC conventions.
   E.g. 5 m/s or 5 ms^{-1}; 22.4 g/mol; 43 kg; $5.4x10^{-3}$ Pa, 45 F, 78 °C
   E.g. Exceptions are percent and degrees of a circle: 54%, 360°
8. **Never use two spaces** after a period, comma or ever! (https://slate.com/technology/2011/01/two-spaces-after-a-period-why-you-should-never-ever-do-it.html).
9. Only use parentheses to cite figures/tables, to cite companies or manufacturers (Thermo Fisher Scientific, Palo Alto, CA) or to provide an abbreviation for the first time you introduce an abbreviation. If information is important enough to include in a passage, provide the information outside of any parentheses.
   Not: Several classes of compounds have been successfully detected on fingerprints including drugs *(both over the counter and illicit)* and explosives.
   But: Several classes of compounds have been successfully detected on fingerprints, including illicit drugs, over-the-counter drugs and explosives.
   E.g. A plot of instrument response versus quantity injected provides a ~~*good*~~ linear response with an R^2 exceeding 0.95 (Figure 2).
   E.g. …as determined by the Fourier Transform Infrared (FTIR) Spectrometer (PerkinElmer, Waltham, MA).
10. **Use existing conventions** and don't make up your own rules! Use existing style guides. This rule applies to: formatting documents; formatting citations; designing and labelling graphs and charts; organizing figure legends in, above or below figures; writing sentences; using mathematics; conducting experiments; proposing acronyms. It is your job to become informed about conventions in your discipline. Always use regular sentence capitalization.
11. **Avoid double negatives**. The affirmative is faster and easier to understand.
    Not: We *never doubted* that...
    But: We trusted that…
    Not: Do *not forget*
    But: Remember
    Not: ...is *not* a *bad* way to...
    But: …is useful to…
12. Learn to **use terms correctly**. When using comparison terms like larger, smaller, heavier etc., always provide the comparison (than…). *While* means *at the same time*, not *in contrast to*. *Over* means *above*, not *greater than*.
    Not: *While* A happened, B did not occur.
    But: Whereas A happened, B did not occur.
    Not: *Over* 200 grams of reagent were added to the mixture…
    But: After 2 minutes, more than 200 grams of reagent reacted with…
    Or: The addition of 200-250 grams of reagent completed the reaction.
13. **Use commas correctly**. Use commas to separate independent clauses when they are joined by any of these seven coordinating conjunctions: *and, but, for, or, nor, so, yet.* An independent clause can form a grammatically complete sentence by itself. If the clause is not independent, you do not need a comma.
    Not: The results demonstrate that the LODs are 3 times better with the new extraction technique and the sensitivity is also better. (also contains the vague, forbidden term "better")
    But: The results demonstrate that the LODs are 3 times better with the new extraction technique, and the sensitivity is improved by a factor of 2.
    Or: Relative to the previous approach, the new extraction technique improves the LODs and sensitivity by factors of 3 and 2, respectively.
14. Use the term *use* for normal uses of tools/approaches. Use the term *utilize* when tools/approaches are used for uncommon or unintended applications. (https://grammarist.com/grammar/use-vs-utilize/)