Achieving Clarity in Scientific Writing

Grant Writing Basics: Predoctoral Applications
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Instructions

• Read through the slides and notes or watch the recorded presentation
  • Note, if only reading through the slides, they are designed so that each slide is read first followed by the accompanying notes.

• Come to class ready to discuss these concepts and apply them to your Specific Aims page
Can you identify what this is? How do you like it? What is it missing for it to be functional?

This is from a calendar; it is with a beautiful image, and the page in general has nice aesthetics.

But, from a users perspective, it’s not very functional as a calendar itself; it’s difficult to determine what month it is (with the exception of the specific month shown) and what days are on which days of the week. And it is difficult for any user to note which dates are important and why, or to use it for planning purposes.

This illustrates that in addition to presentation (aesthetics), if the intended purpose of a document is not clear it is not very useful.

Similarly, for scientific writing, authors need to pay attention to the clarity of a document to make it functional for the reader (e.g., easily understood by readers/reviewers so the information can be correctly interpreted, published, or funded). A document that is written clearly and organized logically greatly improves the readers ability to understand
the information presented.
Here is an illustration of how the structure of the information presented can greatly impact its interpretation by the reader...

- When you generate data where you take the temperature at a certain timepoint, you can represent them as a list, BUT, it is more effective to present them as a table.

- Note that it is most helpful to the reader if you place regular/predictable information on left. Since we read from left to right, we prefer context on the left and new, important information on the right.

Achieving clarity

Readers interpret substance based (in part) on expectations derived from structure.

- e.g. t (time)=0, T (temperature)=25°C, t=5, T=29°C, t=10, T=30°C, t=15, T=32°C, t=20, T=27°C

- is more effectively represented as:

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Temp (°C)</th>
<th>Temp (°C)</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>29</td>
<td>29</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>32</td>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>20</td>
<td>27</td>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>

- but not as:

<table>
<thead>
<tr>
<th>Temp (°C)</th>
<th>Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>5</td>
</tr>
<tr>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>32</td>
<td>15</td>
</tr>
<tr>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>
In scientific writing, following an expected structure helps the reader interpret the information presented, because they have certain expectations as to what information will be provided based on: the paper/grant section; paragraph structure; sentence structure.
Following a known structure that is familiar to reviewers/readers helps them anticipate the type of information to come in that section (and therefore makes it easier to interpret). I won’t spend too much time discussing what information goes into different paper or grant sections as the structure of a paper is relatively straightforward (although am happy to answer any questions about this), and we’ll discuss specific grant sections in other sessions of this course. This is just a reminder to keep in mind that an organizational structure exists and readers are expecting that to be followed for this type of scientific writing.
This talk will focus on techniques you can apply to your own writing to develop good structure at the paragraph and sentence level, which can be applied to any type of scientific writing. We’ll start by focusing on what constitutes good paragraph structure.

Structural clues come from:

• paper divisions/grant sections
• paragraph structure
• sentence structure
Readers also tend to expect a certain type of structure within paragraphs, which can be structured much like an Oreo cookie. A topic sentence (e.g., top of the cookie) provides the reader with context for the new information that follows.

Specific details of an argument or concept can be provided in the middle of the paragraph (cookie filling), with individual sentences connected by linker words and through correct sentence structure (covered in more detail in the coming slides).

A summary sentence (bottom of cookie) provides the reader with the main point/overall takeaway message of the information they just read, or is your interpretation/conclusions of the information presented that you want the reader to know.

Failure to include a topic sentence could leave the reader in the dark and the lack of a summary sentence could leave them wondering which of two (or more) possible interpretations is meant by the information presented.

The use of topic and summary sentence can help connect paragraphs
to each other, and improve the overall flow of a document.
Bauer et al. (1988, 1989), He et al. (1998), Lienert et al. (1998), Kim et al. (2000) and Perry et al. (2001) used boiling solvents to extract different species of Echinacea. Lienert et al. (1998) compared Soxhlet extract with static maceration and supercritical fluid extraction of Echinacea species and reported no differences in chemicals extracted by the three methods. They obtained the highest yields with Soxhlet extraction. Molgaard et al. (2003) claim ultrasonication of Echinacea results in yields comparable to Soxhlet extraction in terms of chemical composition and yield but report no comparative data to support their statement. Pomponio et al. (2002) claim to compare ultrasonication with microwave Soxhlet extraction of Echinacea but provide no quantitative data to support their comparisons. Luo et al. (2003) reported their optimization of different solvent combinations for ultrasonication extraction of Echinacea for phenolic acids and compared their concentrations with the literature.

The majority of extraction literature for Hypericum aims to maximize extraction of hypericin, pseudohypericin, hyperforin and/or flavonoids (Liu et al., 2000; Ganzera et al., 2002; Anaud et al., 2005; Ang et al., 2004; Orth et al., 1999). Smelcerovic et al. (2006) compared six extractions methods for Hypericum and concluded that ultrasonication at 40 watts and Soxhlet extracts were very similar in yield and in the number of chemicals extracted. Bauer et al. (1988, 1989), He et al. (1998) ... used boiling solvents...

Can you determine the overall point the author was trying to make?
Achieving clarity: paragraph level

Let’s try breaking it down by sentence...

- Bauer et al. (1988, 1989), He et al. (1998), Lienert et al. (1998), Kim et al. (2000) and Perry et al. (2001) used boiling solvents to extract different species of Echinacea.
- Lienert et al. (1998) compared Soxhlet extract with static maceration and supercritical fluid extraction of Echinacea species and reported no differences in chemicals extracted by the three methods.
- They obtained the highest yields with Soxhlet extraction.
- Molgaard et al. (2003) claim ultrasonication of Echinacea results in yields comparable to Soxhlet extraction in terms of chemical composition and yield but report no comparative data to support their statement.
- Pomponio et al. (2002) claim to compare ultrasonication with microwave Soxhlet extraction of Echinacea but provide no quantitative data to support their comparisons.
- Luo et al. (2003) reported their optimization of different solvent combinations for ultrasonication extraction of Echinacea for phenolic acids and compared their concentrations with the literature.
- The majority of extraction literature for Hypericum aims to maximize extraction of hypericin, pseudohypericin, hyperforin and/or flavonoids (Liu et al., 2000; Ganzera et al., 2002; Anaud et al., 2005; Ang et al., 2004; Orth et al., 1999).
- Smelcerovic et al. (2006) compared six extractions methods for Hypericum and concluded that ultrasonication at 40 watts and Soxhlet extracts were very similar in yield and in the number of chemicals extracted.
- Bauer et al. (1988, 1989), He et al. (1998) ... used boiling solvents...

Key points to notice, which may be more obvious when the paragraph is broken down by individual sentence.

- The lack of a topic sentence results in the reader plunging into the facts that are provided, with no context as to why this information is being presented.
- The paragraph reads like a list of facts. This is boring and uninformative for the reader.
- There are missing links between the individual sentences, and between the two paragraphs. This results in a choppy flow of information.
- The lack of a summary sentence in the first paragraph makes it hard for the reader to know the main point the author is trying to get across with the above information, and leads to a lack of continuity with the next paragraph.
A number of studies have tested the efficiency of boiling solvents for the extraction of medically relevant compounds from a variety of plant species (Bauer et al., 1988; Bauer et al., 1989; ...). Lienert et al. (1998) also examined different methods—comparing Soxhlet extraction with static maceration and supercritical fluid extraction. This group reported no differences in chemicals extracted by the three methods, but did find that Soxhlet extraction resulted in significantly higher yield. Later, Molgaard et al. (2003) reported that ultrasonication yields products comparable to those obtained by Soxhlet extraction, in terms of both chemical composition and yield, but failed to provide comparative data to support their statement. Similarly, Pomponio et al. (2002) claimed to compare ultrasonication with microwave Soxhlet extraction without providing quantitative data to support their comparisons. Finally, Luo et al. (2003) reported their optimization of different solvent combinations for ultrasonication-mediated extraction of phenolic acids, and compared their concentrations with the literature. Overall these studies leave unclear whether there is a single, effective isolation protocol for these compounds.

In terms of focus, the majority of extraction literature aims to maximize extraction of hypericin, pseudohypericin, hyperforin and/or flavonoids (Liu et al., 2000; Ganzera et al., 2002; Anaud et al., 2005; Ang et al., 2004; Orth et al., 1999). Smelcerovic et al. (2006) compared...

The paragraph can be significantly improved just by adding:
- Introductory and concluding sentences to paragraphs
- Linkers between sentences and paragraphs to indicate how they relate to one another.
Now we'll focus on concepts that are important to consider for crafting good sentence structure.

Achieving clarity

Structural clues come from:

• paper divisions/grant sections
• paragraph structure
• sentence structure
Here are some general guidelines to consider regarding sentence structure.

You don’t always need to do all of this consciously, but if you’re having trouble writing (or following someone else’s writing), try using some of these strategies.

The first points to remember are to place old information that links back to previous information in the topic position; place new information in the stress position.
Achieving clarity: sentence level

The topic position: the beginning of the sentence

- Placing “old” information here:
  - provides perspective and context
  - circumvents having the reader having to hunt for real point of emphasis
  - helps reader construct logical flow of the argument
  - avoids misinterpretation

First example: in the second sentence, the topic position is filled by new information and a link to the first sentence (angiogenesis) doesn’t come up until the reader has gotten to the end of the sentence. This new information disrupts the flow in logic and gives the reader new information in which they have no context to place it. They will likely have to go back and re-read both sentences to get the point.

Second example: in the second sentence, the topic of the first sentence comes up right away, so the reader immediately has context in which to place the new information that follows.
Achieving clarity: sentence level

The stress position: the end of the sentence

• the reader naturally emphasizes material that comes at the end of a sentence

The smallest of the URF’s is URFA6L, a 207-nucleotide (nt) reading frame overlapping out of phase the NH2-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene; it has been identified as the animal equivalent of the recently discovered yeast H+-ATPase subunit 8 gene.

• failure to write accordingly could lead to:
  › a hunt for the real point of emphasis
  › misinterpretation of meaning


This example also highlights the ability to include a secondary stress position if more than one piece of information needs emphasis. For this to work, the author needs to use appropriate punctuation (e.g., semicolon or colon). The material preceding these punctuation marks must stand by itself as a complete clause, thereby introducing another place for a stress position.

This isn’t necessarily something you have to do all of the time, but if you see a confusing sentence, look to see what information is in the topic and/or stress position.

In addition, it is critical to put anything you particularly want to emphasize in the stress position. e.g. conclusions drawn from your experiment.
This solves the question of whether it’s OK to use active or passive voice in scientific writing...

As this example illustrates, either is ok. While active voice is more direct and often preferred, what is most important is putting the subject of the passage first regardless of voice required to do so. This ensures your reader won’t be confused with regard to what you are trying to emphasize.
A further note on active vs. passive voice. The problem is not with passive voice, but that scientists don’t use it well. Active voice is generally thought to be shorter, clearer, and more direct. Passive voice often encourages nominalizations (i.e., turning a verb into a noun), which can obscure the clarity in your writing. We’ll touch on nominalization in a few slides.
Achieving clarity: sentence level

• Place “old information” that “links backward” in the topic position

• Place “new information” in the stress position

• Follow grammatical subject ASAP with its verb

• Articulate action of every clause / sentence in its verb
  • Stick to verbs that convey the action
  • Avoid nominalization and “verbing”

• Avoid dangling modifiers

• Avoid sentences that are overly complicated
  • Avoid noun/adjective strings
Achieving clarity: sentence level

The two primary pieces of information that the reader is looking for:
• who the sentence about (subject)
• what they doing (verb)

Subject-verb placement: follow subject ASAP with its verb
• The verb tells the reader what the subject is doing/what the sentence is about.
• If there is a lot of material between the subject and verb, it is difficult for readers to determine what the sentence is about.
• The text between a subject and its verb can be viewed as an interruption and thus as of minor importance.
• BUT, if there is a lot of intervening information, it suggests that the interrupting material is important after all; however its location will only make it seem like an interruption.

In this example, the subject is “attitudes and perceived comfort” and the verb is “have been noted.” These are separated by a long string of intervening information.

Possible solutions:
1. Move the verb to the start of the sentence and change punctuation to create compound sentence with two important elements, or
2. Move the intervening information into its own sentence, or remove altogether if not important.

ONLY the author can decide which solution to adopt.
Achieving clarity: sentence level

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  - Avoid noun/adjective strings
Readers expect the action of a sentence to be articulated by the verb. If actions are not found in verbs, or if they are not descriptive (e.g., is, are) the reader is left with the responsibility to determine the action of the sentence, which can often lead to misinterpretation. In the above example, the paragraph is difficult to follow because:

- we know only who the players are,
- not really the actions they perform

The clarity of this paragraph can be significantly improved by using verbs that clearly convey the action of the subject. Compare the verbs used in this version relative to the first version.
In the first example, it is vague as to what effects occur due to the Notch mutation, but it is specifically stated in the second.
Articulating the action with the verb can also help eliminate unnecessary words and shorten sentences.

- “diffusible factors are involved in mediating interactions.”
- “diffusible factors mediate interactions.”
- We performed an analysis on the data.
- We analyzed the data.
Failing to describe the action in a verb often occurs when verbs are nominalized (i.e., turned into nouns; highlighted in the red examples).

Often, authors think the use of nominalizations sounds more sophisticated, but that’s because it sounds like legal talk…the goal of which is not necessarily to clarify!
Verbing occurs when a noun is used as a verb in a sentence. Sometimes readers can figure out what you are trying to say, but it often creates more work for them.
For reference, here are a list of descriptive verbs associated with research/analysis.

<table>
<thead>
<tr>
<th>advised</th>
<th>focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>amplified</td>
<td>found</td>
</tr>
<tr>
<td>analyzed</td>
<td>generated</td>
</tr>
<tr>
<td>applied</td>
<td>guided</td>
</tr>
<tr>
<td>assessed</td>
<td>improved</td>
</tr>
<tr>
<td>charted</td>
<td>rejected</td>
</tr>
<tr>
<td>clarified</td>
<td>increased</td>
</tr>
<tr>
<td>coordinated</td>
<td>influenced</td>
</tr>
<tr>
<td>calculated</td>
<td>instilled</td>
</tr>
<tr>
<td>charted</td>
<td>launched</td>
</tr>
<tr>
<td>compiled</td>
<td>led</td>
</tr>
<tr>
<td>composed</td>
<td>mentored</td>
</tr>
<tr>
<td>conducted</td>
<td>organized</td>
</tr>
<tr>
<td>consulted</td>
<td>persuaded</td>
</tr>
<tr>
<td>designed</td>
<td>pinpointed</td>
</tr>
<tr>
<td>detected</td>
<td>pioneered</td>
</tr>
<tr>
<td>developed</td>
<td>planned</td>
</tr>
<tr>
<td>discovered</td>
<td>presented</td>
</tr>
<tr>
<td>documented</td>
<td>processed</td>
</tr>
<tr>
<td>evaluated</td>
<td>refined</td>
</tr>
<tr>
<td>expanded</td>
<td>refocused</td>
</tr>
<tr>
<td>experimented</td>
<td>researched</td>
</tr>
<tr>
<td>examined</td>
<td>restored</td>
</tr>
<tr>
<td>explored</td>
<td>solved</td>
</tr>
<tr>
<td>extracted</td>
<td>stimulated</td>
</tr>
</tbody>
</table>
Achieving clarity: sentence level

- Place “old information” that “links backward” in the topic position
- Place “new information” in the stress position
- Follow grammatical subject ASAP with its verb
- Articulate action of every clause / sentence in its verb
  - Stick to verbs that convey the action
  - Avoid nominalization and “verbing”
- **Avoid dangling modifiers**
- Avoid sentences that are overly complicated
  - Avoid noun/adjective strings
Achieving clarity: sentence level

- Check that adjectives and clauses clearly refer to intended subjects (i.e. avoid dangling modifiers).

Otherwise:
  › the reader may misinterpret your meaning
  › the reader may be amused/annoyed by a clearly inaccurate image
In the first example, the placement of “in the signaling pathway” makes it sound like J. Doe is part of the signaling pathway, rather than having investigated it.
Another example:
In the first example, the wording makes it sound like neurons use whole-mount immunostaining to sprout dendrites.
This can be solved by using punctuation to indicate *at which point neurons normally sprout dendrites* is a separate clause, or by moving that clause to the end of the sentence.
Achieving clarity: sentence level

- Place “old information” that “links backward” in the topic position
- Place “new information” in the stress position
- Follow grammatical subject ASAP with its verb
- Articulate action of every clause / sentence in its verb
  - Stick to verbs that convey the action
  - Avoid nominalization and “verbing”
- Avoid dangling modifiers
  - **Avoid sentences that are overly complicated**
    - Avoid noun/adjective strings
In the first example, the underlined words show the long noun string, making it difficult to determine what is actually being done in the sentence.

In the second example, the introduction of a verb (induced) helps break up the noun string.
achieving clarity
be precise in your wording:
• keep terms consistent
• once you define an abbreviation, continue to use it
• keep points in lists parallel
• use the word that most closely fits your meaning
  • e.g., do not use “different” when you mean “multiple” or “several”
  • avoid empty phrases
• use correct terms
  • use words without a potential time connotation to prevent confusion - “whereas” rather than “while”
  • affect vs effect

for example, once you say “resin-based composite” don’t refer to this as “resin composite,” “resin” or “composite” later on. be consistent with the use of the same term.

the same holds true for abbreviations.
Achieving clarity

Be precise in your wording:

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  • Avoid empty phrases
• Use correct terms
  • Use words without a potential time connotation to prevent confusion - “whereas” rather than “while”
  • Affect vs effect
In this example, there is a list of adjectives describing different cell
types, with some adjectives modifying a noun (non-ciliated columnar,
intermediate, basal) and some not (ciliated, goblet).
Achieving clarity

Keep points in lists parallel:

Shared part of sentence

The human cartilagenous airway is a pseudostratified columnar epithelium consisting of

- ciliated cells
- goblet cells
- non-ciliated columnar cells
- intermediate cells
- (and) basal cells

Some unique components

Partially shared

This can be more clearly observed when the sentence is broken down to show the shared part of the sentence and the list of unique components.
There are two potential ways to make the sentence parallel. Add a noun to all of the adjectives in the list (e.g., cells) or remove the noun from some of the adjectives in the list and leave it until the end of the sentence.
Achieving clarity

Keep points in lists parallel:

The human cartilagenous airway is composed of a pseudostratified columnar epithelium composed of cilated cells, goblet cells, non-ciliated columnar cells, intermediate cells and basal cells.

The human cartilagenous airway is composed of a pseudostratified columnar epithelium composed of cilated, goblet, non-ciliated columnar, intermediate and basal cells.

Here is what it looks like written as a sentence.
The author provides an excellent example of a list that is difficult to understand because its contents are not written in a parallel format (causes the reader to go back because they feel they missed something). Consider the alternative, in which each clause starts with a verb in the same form (i.e., present).
Also use parallel sentence structure. Keep the order of the subject/verb consistent.

In the above example, the context causes the reader to presume that “activating” is used as an adjective and the sentence doesn’t make sense on first read, forcing the reader to backtrack.
Achieving clarity

Parallel structure: another example

Additionally, WT early pro-B cells downregulated genes that promote alternative lineage potential, whereas these factors remained highly overexpressed in Justy early pro-B cells.

Additionally, WT early pro-B cells downregulated genes that promote alternative lineage potential, whereas Justy early pro-B cells retained high expression of these factors.

**Top Example:**
Subject -> verb
Verb -> subject

**Bottom example:**
Subject -> verb
Subject -> verb
Achieving clarity

Be precise in your wording:

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• Use the word that most closely fits your meaning
  • E.g., do not use “different” when you mean “multiple” or “several”
  • Avoid empty phrases
• Use correct terms
  • Use words without a potential time connotation to prevent confusion - "whereas" rather than "while"
  • Affect vs effect
The first phrase highlighted can be more directly stated by using a verb that conveys action ("requires" instead of "is") and the second highlighted phrase is more direct by using the word that most closely relays the intended meaning.
Achieving clarity

Avoid empty phrases:

There have been reports suggesting a decline in the CCSP+ cells in patients that develop BOS following lung transplantation.

Recent reports have suggested that CCSP+ cells decline in patients who develop BOS following lung transplantation.

Additional examples:

• Over the past 15 years, we have had 10 other institutions participate in this consortium.
• The presence of such filter feeders in the early Cambrian suggests that there were high densities of plankton available.

Each of the examples can be understood without the highlighted text, and it is less information for the reader to have to process.
Achieving clarity

### Avoid empty phrases:

<table>
<thead>
<tr>
<th>Instead of</th>
<th>Use this</th>
</tr>
</thead>
<tbody>
<tr>
<td>a majority of most</td>
<td>most</td>
</tr>
<tr>
<td>a number of many</td>
<td>many</td>
</tr>
<tr>
<td>on the basis of</td>
<td>because</td>
</tr>
<tr>
<td>due to the fact that</td>
<td>because</td>
</tr>
<tr>
<td>are of the same opinion</td>
<td>agree</td>
</tr>
<tr>
<td>by means of</td>
<td>by</td>
</tr>
<tr>
<td>despite the fact that</td>
<td>although</td>
</tr>
<tr>
<td>during the course of</td>
<td>during</td>
</tr>
<tr>
<td>Fewer in number</td>
<td>fewer</td>
</tr>
<tr>
<td>has the capability</td>
<td>can</td>
</tr>
<tr>
<td>in close proximity to</td>
<td>near</td>
</tr>
<tr>
<td>in order to</td>
<td>to</td>
</tr>
<tr>
<td>large numbers of many</td>
<td>many</td>
</tr>
<tr>
<td>it is worth pointing out</td>
<td>note that</td>
</tr>
<tr>
<td>prior to/previous to</td>
<td>before</td>
</tr>
<tr>
<td>at the present time</td>
<td>currently</td>
</tr>
<tr>
<td>all of/both of</td>
<td>all/both</td>
</tr>
</tbody>
</table>

Additional examples of empty phrases and possible alternatives.
Achieving clarity

Be precise in your wording:
- Keep terms consistent
- Once you define an abbreviation, continue to use it
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- Use the word that most closely fits your meaning
  - E.g., do not use “different” when you mean “multiple” or “several”
  - Avoid empty phrases
- Use correct terms
  - Use words without a potential time connotation to prevent confusion - “whereas” rather than “while”
  - Affect vs effect
 Achieving clarity

Use correct terms:

• Homophones that are commonly reversed:
  ▪ affect & effect
  ▪ complement & compliment
  ▪ discreet & discrete
  ▪ principle & principal

• Other words that are often confused:
  ▪ imply vs infer
  ▪ insert vs inset
  ▪ alternately vs alternatively

• Use the most informative word
  ▪ multiple vs several
  ▪ approximately vs essentially
  ▪ effectively
  ▪ problem vs issue
  ▪ whereas vs while

IEEE = Institute of Electrical and Electronic Engineers
Achieving clarity: affect vs effect

As verbs, meanings include:

- **affect**: have an effect on, make a difference to, influence
- **effect**: cause something to happen, bring about

This co-receptor affects the efficiency of pathogen binding to host proteins.

Metalloproteases effect protein cleavage.
Achieving clarity: affect vs effect

As nouns, meanings include:

• **affect**: emotion that influences behavior
• **effect**: a result, consequence or impression

Heavily sedated, he spoke without affect.
The effect on binding in this case is minimal.
Achieving clarity

In addition, keep things simple but formal:

- Avoid unnecessary complexity ("use" vs. "utilize", "close" vs. "proximal")
- Keep sentences short (usually)
- Don’t use contractions
- Do not use colloquialisms ("lab", "touch base", "bring up to speed")
- Avoid jargon of the field (define early on if use is unavoidable)
- Avoid redundant wording (e.g. "already existing", "period of time")

Some examples taken from presentation by Judith Bender and Erica Larschan, Brown University
Achieving clarity

And don’t forget …

• Use tense correctly
• Subject-verb agreement (plural vs singular)
• Be concise
• Avoid redundancy
• Use punctuation correctly
• Avoid misspelling words
Achieving clarity

Frequency of tense used in specific research article sections:

<table>
<thead>
<tr>
<th></th>
<th>Introduction</th>
<th>Methods</th>
<th>Results</th>
<th>Discussion</th>
</tr>
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- Use past tense when discussing the experiments carried out in your study, e.g.:
  
  ... colocalization of MMP2 and MMP9 with GFP-SNAP23 and GFP-VAMP3 was specific for these SNAREs.

- Use present tense when discussing what is generally accepted as true based on previous research, OR what your findings reveal, e.g.:
  
  In the neurogenic region of Drosophila, cells normally give rise both to neuroblasts and to cells that form the hypodermal cell layer\(^1\).
  
  The experiments presented below demonstrate that these defects arise from changes in cell fate determination.

The table provides general guidelines of what tense to use in specific sections of a research paper.
For a fun read about punctuation, check out Eats, Shoots & Leaves, by Lynne Truss.
### Appendix B
100 Most Often Misspelled Words

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Achieving clarity

*Enjoy your writing assignments…*

*but don’t be like Calvin*
Does all of this really make a difference?

Freeling et al. reviewed 130 articles (3 different areas) published in 2012-2013 and analyzed them for 11 different measures of writing style (word count, parallel phrasing, punctuation, consistent language, noun chunks, etc).
Their results suggest that published papers that were clearly written were cited more frequently than those that were poorly written, and that this spanned journals of all levels (i.e., impact factor). This provides clear evidence that writing well has an impact!

Link to full article: https://www.pnas.org/content/116/2/341
"Simple can be harder than complex. You have to work hard to get your thinking clean to make it simple. But it's worth it in the end, because once you get there, you can move mountains."

And remember...
Resources (writing):

William Strunk Jr. & E.B. White
*The elements of style* (Fourth Edition)
Allyn and Bacon, 1999

Lynne Truss
*Eats, shoots & leaves: the zero tolerance approach to punctuation*
Gotham Books, 2004

Joseph M. Williams
*Style: Toward Clarity & Grace* (Chicago Guides to Writing, Editing, and Publishing)
The University of Chicago Press, 1995

George Gopen & Judith Swan
*The Science of Scientific Writing*
American Scientist 78, 550-558, 1990
http://www.americanscientist.org/issues/pub/the-science-of-scientific-writing

Writing tips by Gary Westbrook & Linda Cooper
Society for Neuroscience and The Journal of Neuroscience websites
http://www.jneurosci.org/site/misc/publishingpointers.xhtml
http://www.jneurosci.org/site/misc/writingtips.xhtml
### Resources (strategies):

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