

# Achieving Clarity in Scientific Writing

---

**Grant Writing Basics: Predoctoral Applications**  
MSTP:8514, Spring 2023  
The University of Iowa

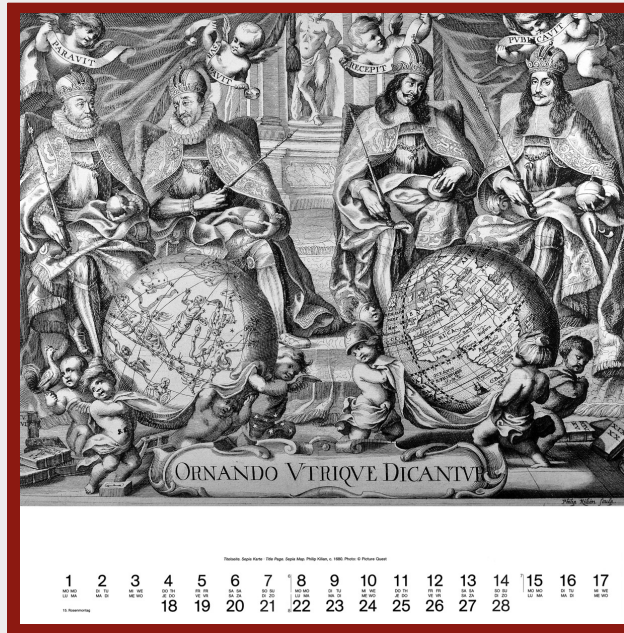
Jennifer Y Barr, PhD  
Scientific Editor and Writing Consultant  
Scientific Editing and Research Communication Core  
UI Carver College of Medicine

## 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

## Aesthetics *versus* clarity



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.



## 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:

Time (min)	Temp (°C)		Temp (°C)	Time (min)
0	25		25	0
5	29	but <u>not</u> as:	29	5
10	30		30	10
15	32		32	15
20	27		27	20

From Gopen & Swan: The Science of Scientific Writing *American Scientist* 78, 550-558. 1990.

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

---

Structural clues come from:

- paper divisions/grant sections
- paragraph structure
- sentence structure

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.

## Achieving clarity: paper/grant sections

---

Put information where the reader is expecting to find it:

- paper divisions/grant sections
  - e.g. discussing your new results throughout introduction would be unexpected/confusing
  - e.g., discussing experimental procedures in significance section of a grant would be confusing

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.

## Achieving clarity

---

Structural clues come from:

- paper divisions/grant sections
- paragraph structure
- sentence structure

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.

## Achieving clarity: paragraph level

---

Limit each paragraph to one major idea, laid out in the following structure:

- Topic sentence:
  - start out by making it clear what this paragraph will be about
  - should clearly link back to subject of previous paragraph
  - should provide context for new information in rest of paragraph
- Supporting information:
  - should follow logically from the topic sentence
  - should include transition words/linkers appropriately to help improve flow between sentences
  - should lead to a conclusion
- Concluding sentence:
  - summary of, or conclusions that can be drawn from, rest of paragraph

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.

## Achieving clarity: paragraph level

---

Read through this example:

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.



## Achieving clarity: paragraph level

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.

## Achieving clarity

---

Structural clues come from:

- paper divisions/grant sections
- paragraph structure
- sentence structure

Now we'll focus on concepts that are important to consider for crafting good sentence structure.

## 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

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

Angiogenesis is the formation of new blood vessels from pre-existing vasculature and plays an important role in health and disease. Endothelial cell dynamics controlled by membrane trafficking is central to the process of angiogenesis.

Angiogenesis is the formation of new blood vessels from pre-existing vasculature, and plays an important role in health and disease. This process is dependent on dynamic changes in endothelial cells, which are in turn controlled by membrane trafficking.

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 NH<sub>2</sub>-terminal portion of the **adenosinetriphosphatase (ATPase) subunit 6 gene**; it has been identified as the animal equivalent of the recently discovered yeast H<sup>+</sup>-ATPase subunit 8 gene.

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

From Gopen & Swan: The Science of Scientific Writing *American Scientist* 78, 550-558. 1990.

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.

## Achieving clarity: sentence level

---

The **topic** versus the **stress** position

- the reader expects the story to be about the “one who showed up first”
- either of the following sentences can be used, depending on the broader context

Health literacy is critical to overall health.

[if topic of paragraph is health literacy]

Overall health is dependent on health literacy.

[if topic of paragraph is overall health]

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.

## Achieving clarity: sentence level

---

The **topic** *versus* the **stress** position

- another example...

NADPH oxidase generates reactive oxygen species.

[if topic of paragraph is NADPH oxidases]

Reactive oxygen species are generated by NADPH oxidase.

[if topic of paragraph is reactive oxygen species]

(*either* the active *or* passive voice is OK to use)

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.

From Gopen & Swan: The Science of Scientific Writing *American Scientist* 78, 550-558. 1990.

## Achieving clarity: sentence level

---

Indeed, health care providers' attitudes and perceived comfort in treating specific populations, for example in a survey of Vancouver dentists who found that only 19 percent of respondents treat elderly patients living in long-term care facilities, have been noted as contributing to the access problem.

Indeed, health care providers' attitudes and perceived comfort in treating specific populations have been noted as contributing to the access problem, as in a survey of Vancouver dentists where only 19 percent of respondents treat elderly patients living in long-term care facilities.  
[If intervening material is important]

Indeed, health care providers' attitudes and perceived comfort in treating specific populations have been noted as contributing to the access problem.  
For example, a survey of Vancouver dentists found that only 19 percent of respondents treat elderly patients living in long-term care facilities.  
[If intervening material is more of an aside]

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

---

- 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

---

Verbs need to convey actions...

As opportunity in this field **expands**, collaborative approaches continue to **be** the best route to both the classification of genomic variants as well as validation of clinically significant genotype-phenotype correlations. Previous practices of data **being** siloed within individual laboratories **are** no longer practical. Opportunities for data sharing and case review across medical sub-specialties – and in some cases, among institutions and laboratories – **are** key as we **embrace** the brave new world of genomic medicine.

### VERBS

expands ... be

being ... are

are

embrace

The actions are vague

From Gopen & Swan: The Science of Scientific Writing, *American Scientist* 78, 550-558, 1990.

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

## Achieving clarity

Verbs need to convey actions...

As opportunity in this field **expands**, collaborative approaches continue to **be** the best route to both **classifying** genomic variants and **validating** clinically significant genotype-phenotype correlations. Previous practices of **siloing** data within individual laboratories **are** no longer practical. **Sharing** and **reviewing** cases across medical sub-specialties – and in some cases, among institutions and laboratories – **will be** key to **reaping** maximal benefits from the brave new world of genomic medicine.

### VERBS

expands ... be  
being ... are  
are  
embrace

### VERBS

expands ... be  
classifying ... validating  
siloing  
are ... sharing  
reviewing  
will be ... reaping

This paragraph is about  
***Best approaches for effectively  
using “big data”***

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.

## Achieving clarity

---

- Use verbs to state what the action is rather than implying it.

Here, we describe  
the effects of the *Notch* mutation on gene expression  
in progenitor B cells.

Here, we describe  
the extent to which the *Notch* mutation influences gene expression  
in progenitor B cells.

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..

## Achieving clarity: sentence level

---

- 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

## Achieving clarity: sentence level

---

- Also avoid nominalization (i.e., making useful verbs into nouns)

...a prolongation in median survival can be achieved.



...median survival can be prolonged.

Expressing Archaeorhodopsin (Arch) allows inhibition of glutamate release at 561nm light, while Channelrhodopsin (ChR2) allows stimulation of synaptic terminals at 473nm light.



Expressing Archaeorhodopsin (Arch) inhibits glutamate release at 561nm light, while Channelrhodopsin (ChR2) stimulates synaptic terminals at 473nm light.

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!



## Achieving clarity: sentence level

- Also avoid turning useful nouns/adjectives into verbs (i.e., “verbing”)



I suggest the authors give more detail of the essential role of the mitochondria to evidence their argument

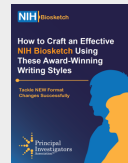


I suggest the authors give more detail of the essential role of the mitochondria to provide evidence for their argument

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.

## Appendix A 50 Research and Analysis Power Verbs (for Writing Strong Sentences)

advised	focused
amplified	found
analyzed	generated
applied	guided
assessed	improved
chaired	instituted
clarified	increased
coordinated	influenced
calculated	installed
charted	launched
compiled	led
composed	mentored
conducted	organized
consulted	persuaded
designed	pinpointed
detected	pioneered
developed	planned
discovered	presented
documented	processed
evaluated	refined
expanded	refocused
experimented	researched
examined	restored
explored	solved
extracted	stimulated



For reference, here are a list of descriptive verbs associated with research/analysis.

## 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).

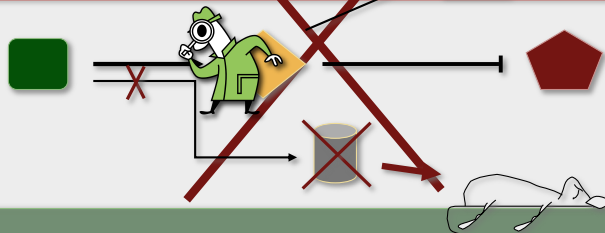
Otherwise:

- > the reader may misinterpret your meaning
- > the reader may be amused/annoyed by a clearly inaccurate image

## Achieving clarity: sentence level

- Check that adjectives and clauses clearly refer to the intended subject...

In the signaling pathway, J. Doe showed the importance of inadequate regulation.



J. Doe showed the consequences of inadequate regulation of the signaling pathway.

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.

## Achieving clarity: sentence level

---

- Check that adjectives and clauses clearly refer to the intended subject...

We examined neurexin deposition at E15, at which point neurons normally sprout dendrites by whole-mount immunostaining.

We examined neurexin deposition at E15, at which point neurons normally sprout dendrites, by whole-mount immunostaining.



We used whole-mount immunostaining to examine neurexin deposition at E15, at which point neurons normally sprout dendrites

### 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

## Achieving clarity: sentence level

---

- Avoid sentences that are overly complicated
  - > keep wording simple to help avoid dangling modifiers, poorly assigned articles, and loss of logical thread
- Avoid noun/adjective strings

... Nox1-containing NADPH oxidase-induced O<sub>2</sub><sup>\*</sup>-mediated  
EGFR transactivation



... O<sub>2</sub><sup>\*</sup>-mediated EGFR transactivation induced by Nox1-containing  
NADPH oxidases.

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:

- 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

## Achieving clarity

---

Keep points in lists parallel:

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

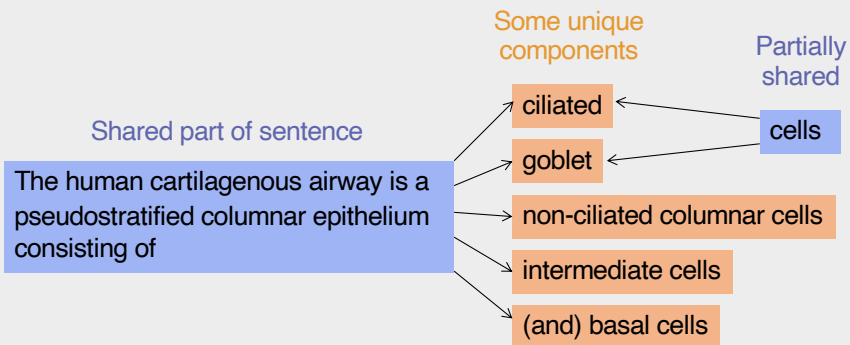
 = adjective

 = noun

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:



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.

## Achieving clarity

Parallel lists:

The human cartilagenous airway is a pseudostratified columnnar epithelium consisting of

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

Shared part of sentence

The human cartilagenous airway is a pseudostratified columnnar epithelium consisting of

- ciliated
  - goblet
  - non-ciliated columnnar
  - intermediate
  - (and) basal
- Shared cells

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 ciliated 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 ciliated, goblet, non-ciliated columnar, intermediate and basal cells.

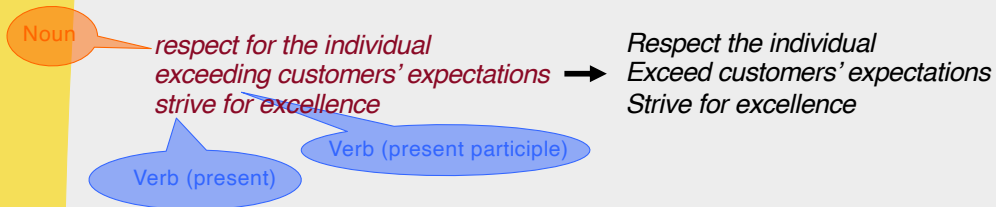
Here is what it looks like written as a sentence.

## Achieving clarity

---

Keep lists parallel:

- Barbara Ehrenreich, on her experience training as a Wal-Mart Associate:  
*Over and over we hear in voiceover or see in graphic display the 'three principles,' which are maddeningly, even defiantly, nonparallel...*
- That text:



Barbara Ehrenreich;; *Nickel and Dimed: on not getting by in America*; Picador, 2001.

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).

## Achieving clarity

---

### Use parallel sentence structure

Melanomas often persist with little contact to the extracellular matrix, and activating integrins by the application of extracellular antagonists markedly increases their sensitivity to chemotherapy.

Melanomas treated with chemotherapeutics

- often persist when they have little contact to the extracellular matrix,
- but rapidly shrink/die when extracellular antagonists are also applied.

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:

- 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

## Achieving clarity

---

Use the word that most closely fits your meaning:

Craniofacial development **is the result of** a series of complex regional interactions between environmental, genetic, and epigenetic factors. Disturbances in any of these factors and/or interactions **can result in** craniofacial anomalies, such as cleft lip or palate (CL/P), craniosynostosis, hemifacial microsomia, and others.

Craniofacial development **requires** a series of complex regional interactions between environmental, genetic, and epigenetic factors. Disturbances in any of these factors and/or interactions **can cause** craniofacial anomalies, such as cleft lip or palate (CL/P), craniosynostosis, hemifacial microsomia, and others.

(makes it easier to avoid repetition)

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:

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

*Constance Baldwin,  
Dept. Pediatrics  
University of Rochester*

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
- 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

## 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 different
  - 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



**LYNNE TRUSS**  
With a Foreword by Frank McCourt,  
author of *Angela's Ashes*

## Achieving clarity

Frequency of tense used in specific research article sections:

	Introduction	Methods	Results	Discussion
Present tense	+++	+	+	+++
Past tense	++	+++	+++	++
Passive voice	+	+++	variable	variable
Citations	+++	+	variable	+++
Qualifications	++	+	++	+++
Commentary	+++	+	variable	+++

Reproduced from Table 21, Swales & Feak, 2004, *Academic Writing for Graduate Students: Essential Tasks and Skills* (second edition). University of Michigan Press.

- 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<sup>1</sup>.*  
*The experiments presented below **demonstrate** that these defects **arise** from changes in cell-fate determination.*

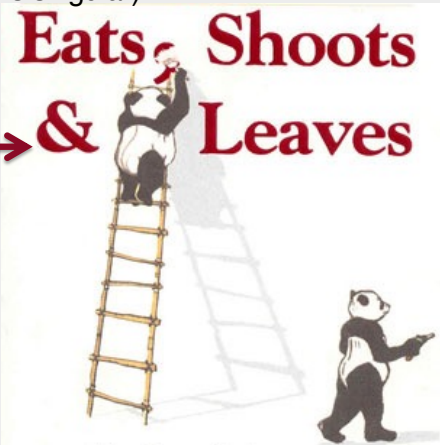
The table provides general guidelines of what tense to use in specific sections of a research paper.

## 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

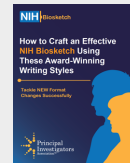


For a fun read about punctuation, check out  
by Lynne Truss

**LYNNE TRUSS**  
With a Foreword by Frank McCourt,  
author of *Angela's Ashes*

## Appendix B 100 Most Often Misspelled Words

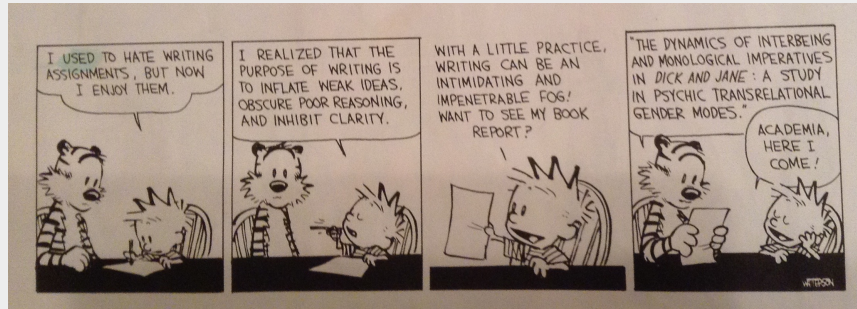
absence	column	humorous	privilege
accidentally	committed	incidentally	pronunciation
accommodate	conceivable	inevitable	receive
achievement	conscience	inoculate	referring
acquaintance	conscientious	irresistible	restaurant
acquire	conscious	license	schedule
all right	criticism	lightning	seize
amateur	criticize	loneliness	separate
analyze	definitely	maintenance	sergeant
apparent	desperate	maneuver	similar
appearance	dilemma	mathematics	sophomore
arctic	disastrous	mischievous	succeed
argument	eighth	noticeable	supersede
arithmetic	eligible	occasionally	susceptible
ascend	embarrass	occurred	transferring
athletic	environment	occurrence	truly
attendance	especially	parallel	tyranny
beginning	exaggerate	particular	unanimous
believe	existence	pastime	undoubtedly
beneficial	extraordinary	permissible	unnecessary
business	familiar	perseverance	usually
calendar	February	phenomenon	vacuum
candidate	foreign	practically	villain
cemetery	government	preferred	weird
changeable	height	prejudice	whether



## Achieving clarity

---

***Enjoy your writing assignments...***



***but don't be like Calvin***

## Achieving clarity



OPINION

Or increase grant funding

### How can we boost the impact of publications? Try better writing

Benjamin Freeling<sup>a</sup>, Zoë A. Doubleday<sup>a</sup>, and Sean D. Connell<sup>b,1</sup>

Peer-reviewed articles are the currency of science. They create knowledge and enable discovery. Despite this fundamental role, peer-reviewed articles tend to be written in a dry, dense, and impersonal style that can be challenging to read and understand (1–4). There are many potential benefits for writing in a more accessible style, from promoting much-needed communication among disciplines to making science more accessible to a broader community (5, 6). But good writing takes time for both the author who writes it and the institutions that teach it. So, is there really any benefit to writing better? We believe there is, and we believe our preliminary research underscores that conclusion.

To address the impact of better, clearer writing, we analyzed 130 peer-reviewed articles for 11 measurable

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).



## Achieving clarity

*“Our model suggests that increases in clarity, narrative structure, and creativity could translate to a boost in citations.”*

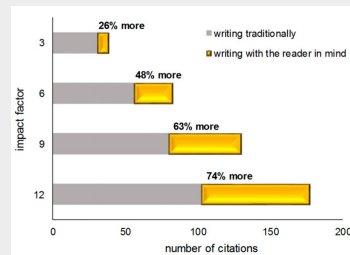
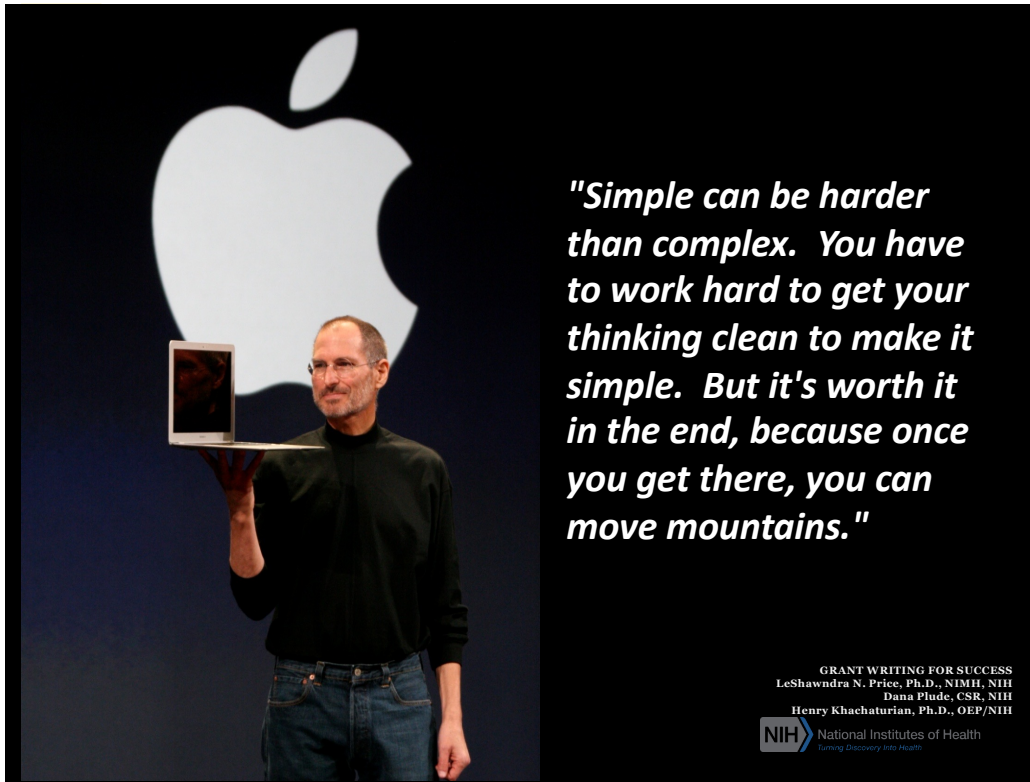


Fig. 1. Writing with the reader in mind can boost the citation rate of scientific articles. Based on our data, this boost occurs wherever you publish. But the higher the impact factor, the greater benefit you will receive. Bars show the number of citations each article has accumulated, on average, over a 6-year period. The grey bars represent articles written in the traditional style, and the gold bars represent articles written more with the reader in mind.

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>



And remember...

## Resources (writing):

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



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>



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

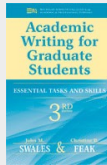
Joseph M. Williams  
*Style: Toward Clarity & Grace*  
(Chicago Guides to Writing,  
Editing, and Publishing)  
The University of Chicago Press  
1995



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):

---



John Swales & Christine Feak  
*Academic Writing for Graduate Students, 3<sup>rd</sup> Edition.*  
University of Michigan Press, 2008



Philippa Benson & Susan Silver  
*What Editors Want*  
*An Author's Guide to Scientific Journal Publishing*  
The University of Chicago Press, 2012

Carol Denbow

*20 Acclaimed Authors and Their Unique Writing Rituals*

A Book Inside – How to Write and Publish a Book, Sunday, January 23, 2011

<http://abookinside.blogspot.com/2011/01/20-acclaimed-authors-and-their-unique.html>

Kathleen O'Shaughnessy, Connie McDonald, Harriet Maher, Anne Dobie  
*Who, What, When, and Where of Writing Rituals*

The Quarterly, Vol. 24, No. 4 (*National Writing Project*), Fall 2002  
<http://www.nwp.org/cs/public/print/resource/456>



Mark Gaipa

*Breaking into the Conversation: How Students Can Acquire Authority for Their Writing.*

*Pedagogy*, Volume 4, Issue 3, pp. 419-437; Duke University Press, 2004

<http://muse.jhu.edu/journals/ped/summary/v004/4.3gaipa.html>