

## A Clarity Clinic for Scientific Writing



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First, some reflections on writing....

### Why this?

An appreciation of these aspects is fundamental to an understanding of the natural history of peritoneal carcinomatosis and to the interpretation of the efficacy of new treatment modalities.

### Instead of this?

The natural history of peritoneal carcinomatosis must be understood in order to determine whether new treatments are effective.

What are the problems here ?

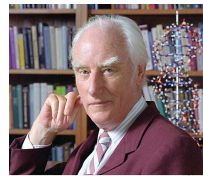
- ✓ Wordy, abstract, inflated writing style (ion verb forms, multisyllabic words used instead of simpler ones)

#### Instead of this:

An appreciation of these aspects is fundamental to an understanding of the natural history of infectious diseases and to the interpretation of the efficacy of new treatment modalities. (28 words)

#### How about this?

The natural history of infectious diseases must be understood in order to determine whether new treatments are effective. (18 words)



There is no form of prose more difficult to understand and more tedious to read than the average scientific paper.

Francis Crick

*The Astonishing Hypothesis, 1994*

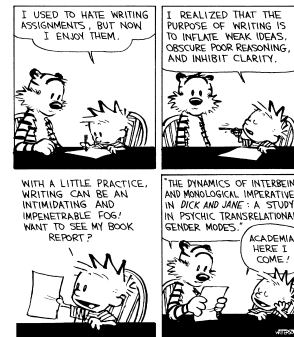
Why do you think this problem persists?

### Novice Writers Can't Master It All!

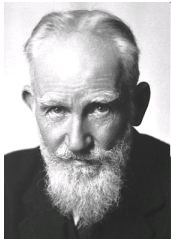
As a novice in a field reads its professional prose, he will predictably try to imitate those features of style that seem most prominently to bespeak membership, professional authority. And in complex professional prose, no feature of style is more typical than **clumps of Latinate abstractions**:

*Individualized assessment of the appropriateness of the death penalty...*  
An appreciation of these aspects is fundamental to an understanding of... **(sound familiar?)**

*John M. Williams, Style. Towards Clarity and Grace, 1990*



### Course Mantra #1



In literature the ambition of the novice is to acquire the literary language; the struggle of the adept is to get rid of it.

*G. B. Shaw*

### Course Mantra #2



Clear writing is writing that is incapable of being misunderstood.

*Quintilian, 1st Century AD*

Synonyms for *scientific*, according to Roget's Thesaurus:

- meticulous
- delicate
- undeviating
- accurate
- sensitive

Not listed as synonyms for *scientific*:

- complicated*
- contorted*
- longwinded*

Clear prose style takes place at the level of...

1. the word
2. the sentence
3. the paragraph

## Word Choice



Words in scientific writing should be...

1. **Precise** (increase/decrease NOT change; dog, mouse, NOT animal)
2. **Simple** (prior to→before, following→after, initiate→begin)
3. **Necessary** (fewer words = less “noise” and more message)
4. **Familiar**  
Do not invent words (endorphinized→injected endorphins)  
Avoid jargon  
Limit use of abbreviations
5. **Humane** (*the patient did not fail therapy*)

*Mimi Zeiger, Essentials of Writing Biomedical Research Papers*

## 1. Use Precise Words

### Example

Maximal coronary vasodilation with carbochromen had other effects.



## Use Precise Words

### Revision

Maximal coronary vasodilation induced by carbochromen had other effects.



## Use Precise Words

### ***What do you really mean by “with”?***

- with—by, when
- with—upon
- with—resulting in, creating
- with—plus, and, containing

### Use Precise Words

#### Example

Renal blood flow was drastically compromised when the aorta was obstructed.

### Use Precise Words

#### Revisions

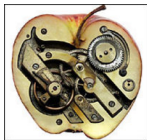
Renal blood flow was greatly decreased when the aorta was obstructed.

Renal blood flow was reduced by X% when the aorta was obstructed.

### 2. Use Simple Words

#### Example

The superiority of this technique has not previously been demonstrated.



### Use Simple Words

#### Revisions

Whether this technique is better is not known.

We are the first to show that this technique is better.



### Use Simple Words

*administer* for *give*

*demonstrate* for *show*

*employ or utilize* for *use*

*encountered* for *found*

*following* for *after*

### Use Simple Words

*How Many Ways Can You Say "Is"?*

*constitutes*

*exists*

*represents*

*serves as*

### Find a Simple Word For...

*encountered*  
*majority*  
*methodology*  
*modality*  
*modify*  
*optimum*  
*paradigm*  
*perform*  
*prior to*  
*superior to*

### 3. Use Necessary Words

one of the  
small number of  
a limited number of  
a proportion of  
a sufficient number of  
a number of  
a sizable number of  
a majority of  
fewer in number

### Use Necessary Words

has the capability to.....can  
is of the opinion that.....believes  
was unable to.....could not  
was applicable to.....applied  
as a consequence of.....because  
accounted for by the fact that...  
at the present moment.....  
at this point in time.....  
by means of.....

### Use Necessary Words (Omit Entire Phrases)

It is important to acknowledge that  
It is interesting to note that  
It is not impossible that  
A not unlikely cause could be that  
It may be said that  
It is not a large theoretical leap to consider that  
It has been reported that...etc

### What Can Be Cut?

Oxygen uptake in response to drugs was examined and found to vary considerably.

**Oxygen uptake varied considerably.**

Anesthesia under wartime conditions.

**Anesthesia during war.**

Symptoms of a neurological nature.

**Neurological symptoms.**

### What Can Be Cut?

pursuit and understanding

underlie or influence

interest and concern

breadth and scope

act to produce

## What Can Be Cut?

Many **but not all** of the agents also have valuable analgesic and antipyretic effects.

Aspirin is **generally considered to be** the primary therapy for most forms of arthritis.

It is usually wise, **unless there is good reason to the contrary**, to start retreatment with the least toxic drug.

**All of these phrases can be deleted without loss of intellectual caution (e.g., *many, usually* still remain).**

## 4. Use Familiar Words



The chief merit of language is clearness, and we know that nothing detracts so much from this as do unfamiliar terms.

~ Galen (AD 129–c. 200)

## Familiar ≠ Abbreviations

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"Take this report and reduce it to an acronym."

Research ID: rda1292

Many words and whole phrases can be cut!

The first principle of word choice is clarity.

Abbreviations definitely detract from clarity.

## Few abbreviations

Used often enough in the paper so that the reader does not forget the meaning (> 10 X).

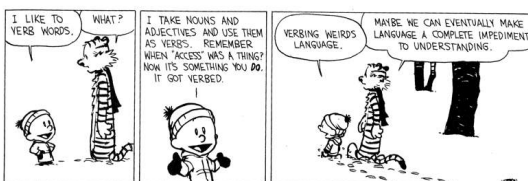
Readers can handle 2-3 abbreviations per paragraph.

Readers won't notice that you write terms out—they'll just have an easier time reading your paper.

Standard abbreviations for units of measurement can be used freely.

Mimi Zeiger, *Essentials of Writing Biomedical Research Papers*

## Familiar ≠ jargon



In English, words enter as nouns and leave as verbs (biopsy), but that doesn't mean you can make up verbs... like spinalized, coverslipped, etc.

## 5. Use Humane Words

**Example.** The oncologist and his associates can do much to encourage his patients to remain optimistic.

### Use Humane Words

**Revision.** Oncologists and their associates can do much to encourage patients to remain optimistic.

### Use Humane Words

**Example.** Four of the patients who failed radiation therapy were placed on a chemotherapy regimen.

### Use Humane Words

**Revision.** Four of the patients for whom radiation therapy failed underwent chemotherapy.

### Sentence Structure



1. Use Active and Passive Voice Selectively
2. Put the Action in the Verb
3. Untangle Noun Clusters
4. Write Shorter Sentences
5. Use Clear Pronouns
6. Write Comparisons Clearly
7. Ensure that Subject and Verb Make Sense Together
8. Avoid Dangling Modifiers
9. Keep the Subject and Verb Close Together

#### 1. Active vs. Passive Voice

Use the **active voice** to focus on the person who is performing the action, as when stating a goal, intention, or hypothesis.



“We wish to suggest a structure for the salt of the deoxyribose nucleic acid (D.N.A.).”

JD Watson & FHC Crick  
(1953)

Use the **passive voice** to emphasize the object that is being acted upon, as in describing a method.

DNA was extracted.

Cells were washed.

Contrast agent was injected.

### Active vs. Passive in the Methods Section

Use active voice in the Methods when the researchers (or their thoughts, inferences, or assumptions) are important.

Because inflammation had never been observed in these patients, **it was assumed that** inflammation was not responsible for their symptoms.

vs

Because **we** never observed inflammation in these patients, **we assumed that** inflammation was not responsible for their symptoms.

### 2. Put the Action in the Verb

#### Example

Elimination of genomic DNA was performed.

#### Revise?

### Put the Action in the Verb

#### Revision

Genomic DNA was eliminated.

### Put the Action in the Verb

#### Liberate Imprisoned Verbs!

Look for "increase" and "decrease" as nouns.

Look for weak verbs, such as...

occurred  
was achieved  
was observed  
was noted  
was seen



### Liberate Imprisoned Verbs!

Look for nouns made from verbs:

-tion	prolongation, formation
-ment	measurement, assessment
-ence	occurrence, existence
-al	removal, disposal

### Liberate Imprisoned Verbs!

**Example:** Isolation of cells was carried out as previously described.

**Revision:** Cells were isolated as previously described.

### 3. Untangle Noun Clusters

**OK:** one noun modifying another

- blood flow
- lung function

Would you say “a tea containing cup”?



### Untangle Noun Clusters

**Not OK:** > 1 noun added to existing pair of nouns

- 0 antigen mismatched deceased donor kidney
- iron containing globules
- hyaluronidase treated area
- methylene blue stained preparation
- adenosine triphosphate activated actomyosin contraction

These are all “clusters” of modifiers piled up before the word they modify. **They are confusing.**

They make the reader pause to decode your meaning.

### Untangle Clusters

Globules that contain iron

An area treated with hyaluronidase

A preparation stained with methylene blue

An actomyosin contraction activated by adenosine triphosphate

Add the *prepositions*.

Use *hyphens* between words that go together.

#### 4. Write Shorter Sentences

Average length should be < 22 words.

Balance 2 or 3 long sentences by writing a short sentence.

The short sentence has the strongest impact.

#### 5. Use Clear Pronouns

**Pronoun: Word that replaces and refers to a noun:**

it, he, she, they, those, these, them

this, that, which...

#### Use Clear Pronouns

##### Example

We abruptly occluded the venae cavae before analyzing the heart beats. As a result of this, the volume of the right heart rapidly decreased.

What does "this" refer to?

#### Use Clear Pronouns

##### Revision

We abruptly occluded the venae cavae before analyzing the heart beats. As a result of this occlusion, the volume of the right heart rapidly decreased.

#### Use Clear Pronouns

##### Example

A bolus of contrast material decreases the relative error by producing a larger change in CT number. This is limited by the relative difficulty of administering a bolus and by the patient's tolerance.

In the example, this has no antecedent. The reader has to fill in the gap. That means clarity has been lost.

#### Use Clear Pronouns

##### Possible Revisions

The size of the bolus is limited...

The size of the relative error is limited...

The size of the CT number is limited...

## 6. Write Comparisons Clearly



- ✓ Overuse of “compared to”
- ✓ Comparison of unlike things

## Write Comparisons Clearly

### Example

The men had a 28% decrease in compliance as compared to women.

What happened in the women?

## Write Comparisons Clearly

### Decrease in both groups?

The men had a 28% greater decrease in compliance than did the women.

## Write Comparisons Clearly

### Decrease only in the men?

The men had a 28% decrease in compliance but the women had no decrease.

## Write Comparisons Clearly

### Decrease in neither group (the men just had *less*)?

The men had 28% less compliance than did the women.

## Write Comparisons Clearly

It's often simpler to use “higher than” or “lower than”, rather than “compared to”.

Check your comparison statements to make sure it's clear what happened in the second group being compared.

### Write Comparisons Clearly



*Don't compare apples and oranges!*

**Example:**

These results were similar to previous studies.

### Write Comparisons Clearly

**Rev 1 :** These results were similar to results of previous studies.

**Rev 2:** These results are similar to those of previous studies.

### 7. Be Sure Subject and Verb Make Sense Together

**Example.** Controls were performed.

**Revision.** Control experiments were performed.

### Subject and Verb Make Sense Together

**Example**

Patients **were** interviewed by a trained nurse and compliance with therapy **determined** one month after treatment began.

What happens when you leave out the “helping verb” before “determined”? You get *therapy were determined*.

### 8. Avoid Dangling Modifiers



After making the midline skin incision, the patient has self-retaining retractors placed to retract his scalp.

### Avoid Dangling Modifiers

**After making** the midline skin incision, **the patient** has self-retaining retractors placed to retract his scalp.

When the “ing” verb form appears at the beginning of the sentence, look for what comes after the comma.

Whatever word comes after the comma is the “doer” of the action.

## Avoid Dangling Modifiers

### Revisions

(1) Insert the correct "actor" after the comma:

After making the midline skin incision, the surgeon places self-retaining retractors to retract the scalp.

(2) Avoid the "ing" verb form:

After the midline skin incision is made, self-retaining retractors are placed to retract the scalp.

## 9. Keep the Subject and Verb Close Together

**Example:** An increase in mRNA, which resulted from transcriptional upregulation by factors binding to the API site, was observed.

**Where is the subject in this sentence?**

**How many words come between it and the verb?**

## Keep the Subject and Verb Close Together

### Revisions

We observed an increase in mRNA, which resulted from transcriptional upregulation by factors binding to the API site.

Messenger RNA increased as a result of transcriptional upregulation by factors binding to the API site.

## Paragraphs



## Paragraphs Make Writing Accessible

- by **breaking your writing up** so that readers do not encounter long, unbroken stretches of print.
- by **organizing and developing ideas** into paragraph form, treating *each idea* in a *paragraph*, and connecting the paragraphs to each other.

## For a Paragraph to Tell a Clear Story...

- The ideas in the paragraph need to be organized.
- The relationship between ideas (continuity) must be clear.
- Important ideas must be emphasized.

## Paragraph Organization



Overview first, then details...

## Paragraph Organization

*Use topic sentences* to state the main idea of the paragraph clearly and directly.

*Keep topic sentences* short and simple.

## Topic Sentences

### Examples

The reasons why coronary artery disease becomes more common in women after menopause are not certain.

Adjusting for potential confounders had little effect.

## Supporting Sentences

*Details that support the topic sentence* are written in the remaining sentences, which are organized in a logical way.

## Patterns of Paragraph Organization

Cause and effect (or effect and cause)

Comparison and contrast

Definition

Illustration

Classification

Narration or process

Analogy

## What Pattern is Used Here?

Problem gambling leads to other socially destructive behavior. According to Lorenz, problem gamblers not only tend to have a high number of auto accidents, but they often don't have insurance to cover the costs of damages. This not only results in economic losses and physical problems to themselves, but to others involved in the accidents, etc etc.

### Patterns of Paragraph Organization in Scientific Writing

Most to least important  
Pro-con  
Pro  
Con  
Chronological order  
Problem-solution  
Solution-problem

### Creating Continuity Within and Between Paragraphs

1. Repeating key terms
2. Using transitions to indicate relationships between ideas
3. Keeping a consistent point of view

### Key Terms

name important ideas in the paper...

can be technical:  
G-protein ♦ mitogenesis ♦ decisional conflict

can be non-technical:  
increase ♦ function ♦ rural

should be repeated exactly from sentence to sentence and paragraph to paragraph.



### Key Terms

#### Example

Digitalis increases the contractility of the heart. This change in inotropic state is a result of changes in calcium flux through the muscle membrane.

### Key Terms

#### Revision

Digitalis increases the contractility of the heart. This increased contractility is a result of changes in calcium flux through the muscle membrane.

### Transitions

Transitions can be words or phrases:

therefore \* thus \* for example  
first \* second \* third \* last  
in addition \* in contrast \* however  
because \* furthermore/moreover  
in brief \* although \* whereas

### Transitions

Are most effective when placed *at the beginning* of a sentence.

Are one of the most useful things a writer can do to make the story of a paragraph clear.

### Transitions

#### Example

Our working hypothesis that triglyceride-rich lipoproteins are integral components of the immune system **is supported by the following observations**. First, ... Second, ... Third,... Finally,...

### Transitions

**What if no transition word exists to make a transition that the author wants?**

Create a phrase...

<sup>A</sup>Our aim was to assess whether consultation planning could benefit Latino and Native American patients with breast cancer. <sup>B</sup>For this assessment, we first determined how consultation planning could be modified to meet the needs of the specific cultural groups.

### Transitions

**What if no transition word exists to make a transition that the author wants?**

Create a phrase...

To determine whether our approach was sensitive, we...

### Transitions & Key Terms Used Together

Telehealth supports the organization of health care delivery on a regional basis, allowing greater access to specialized resources and better distribution of on-call duties between physicians from a whole region. **Therefore**, an indirect impact of telehealth is increased autonomy for rural and remote regions. This autonomy could generate tension between regions and levels of care since specialised services could be directly accessed via telehealth instead of the usual referral process. **Thus**, it is important to respect usual referral patterns when implementing telehealth.

### Point of View





### Point of View

#### Example

The control injection of naloxone produced no significant changes in arterial pressure or heart rate. The arterial pressures and heart rates measured after 24 h of morphine infusion did not change significantly.

### Point of View

#### Revision 1

The control injection of naloxone produced no significant changes in arterial blood pressure or heart rate. Twenty-four hours of morphine infusion produced no significant changes in arterial blood pressure or heart rate.

### Point of View

#### Revision 2

Neither control injection of naloxone nor the 24-h morphine infusion significantly altered arterial blood pressure or heart rate.

### Summary

1. Choose words that are precise, simple, necessary, and humane.
2. Express the action of a sentence in the verb.
3. Use passive voice selectively.
4. Use clear pronouns.
5. Write comparisons correctly, clearly, and simply.
6. Watch out for dangling modifiers.
7. Organize paragraphs by using topic sentences and supporting sentences.
8. Keep continuity going within a paragraph by repeating key terms, using transitions, consistent order, and consistent point of view.



More Exercises

### Exercise 1: How might you revise?

**It has been shown that HIV/hepatitis B virus (HBV)-co infected patients have an increased risk of cirrhosis and liver disease-related death. To date, neither the optimal time point for initiation of anti-HBV therapy nor the best therapeutic approach has been clearly defined.**

### Exercise 1: How might you revise?

It has been shown that HIV/hepatitis B virus (HBV)-co infected patients have an increased risk of cirrhosis and liver disease-related death. To date, neither the optimal time point for initiation of anti-HBV therapy nor the best therapeutic approach has been clearly defined.

### Exercise 1: How might you revise?

Patients co-infected with HIV and hepatitis B (HBV) have an increased risk of cirrhosis and liver disease-related death. To date, neither the best time point for starting anti-HBV therapy nor the best therapeutic approach has been clearly defined.

### Exercise 2: How might you revise?

Recently a study has shown that there has been a disproportionate reporting between the TB laboratory register and treatment register. There has been more reporting in the laboratory registers compared to treatment registers as was demonstrated by a study in Malawi where 15% of the patients that appeared in the laboratory register did not appear in the treatment register

### Exercise 2: How might you revise?

Recently a study has shown that there has been a disproportionate reporting between the TB laboratory register and treatment register. There has been more reporting in the laboratory registers compared to treatment registers as was demonstrated by a study in Malawi where 15% of the patients that appeared in the laboratory register did not appear in the treatment register.

### Exercise 2: How might you revise?

Disproportionate reporting between the TB laboratory register and treatment register was recently shown in a study in Malawi. In that study, 15% of the patients entered in the laboratory register did not appear in the treatment register.

### Exercise 3: How might you revise?

Success in HIV vaccine development does not only depend on number of trials conducted but also depends on retention of those who volunteer.

### Exercise 3: How might you revise?

Success in HIV vaccine development does not only depend on number of trials conducted but also depends on retention of those who volunteer.

### Exercise 3: How might you revise?

Successful HIV vaccine development depends on the quality? of clinical trials conducted. For a trial to yield valid results, the retention rate for study subjects must be high.

### Sources

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