Write!

(as if your career depends on it)

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Write for your reader

Some Simple Principles of Audience Design:

1. Omit needless words
2. Write text that *could* be spoken aloud
3. Write to be read
4. Organize top-down; use topic sentences *(global coherence)*
5. Pay attention to information flow *(local coherence)*
6. Beware of jargon; choose just the right word

Concluding advice for clear and lively scientific writing

2

Omit needless words

"The main purpose of any scientific article is to convey in the fewest number of words the ideas, procedures, and conclusions of an investigator to the scientific community. Whether or not this admirable aim is accomplished depends to a large extent on how skillful the author is in assembling the words of the English language."

(Gaafar, 1981, "Use, misuse and abuse of language in scientific writing", used as a bad example by Gregory, 1992)

3

Omit needless words

"The purpose of any scientific article is to convey in the fewest words the ideas, procedures, and conclusions of an investigator. Whether this aim is accomplished depends on how skillful the author is in the language."

(Gaafar, 1981, "Use, misuse and abuse of language in scientific writing", used as a bad example by Gregory, 1992)

4

On writing as you speak

(well, not exactly - just don't write anything
that you would feel ridiculous saying out loud!)

Remember that text is different from speech.

"The following methodology was utilized."
"The following method was used."
"This is what I did."

(From William Deresiewicz, "You talking to me?"
The New York Times Book Review, Sunday, January 9, 2005, p. 27)

5

A corollary to *writing as you speak*:

Do not refer to yourself in the third person, or as the "royal we."

With no guidance, scientists may copy what they see, leading to atrocities like this:

'The author is of the opinion that it is appropriate to write scientific papers in the third person.'

This is ridiculous. *I* am the author, not a third person.

(Adapted from *Gregory, 1992, p. 12)*

6

Do put yourself into the picture

(especially for fellowships or CAREER proposals)

It's ok to use the pronoun "I"

Make it clear which good ideas are yours!
Do not expect reviewers to know the literature well enough to make this inference on their own.

Hedge if necessary: "*To my knowledge, this is the first time this hypothesis has been tested.*"

7

Write to be read

From an actual article, quoted in Gregory, 1992:

"All of these measurements have wide ranges of values in both control (Doniach & Shiner, 1957; Butterworth & Perez-Santiago, 1958; Rubin et al., 1960a, 1960b Shiner & Doniach, 1960; Chacko, Job, Johnson, and Baker, 1961; Cameron et al., 1962; Jos, 1963; Yardley, Bayless, Norton, & Hendrix, 1962; Astaldi, Conrad, Ratto, & Costa, 1965; Madanagopalan et al., 1965; Swanson & Thomassen, 1965; Stewart, Pollock, Hoffbrand, mollin, & Booth, 1967; Pollock, Nagle, Jeejeebhoy, & Coghill, 1970) and coeliac (Rubin et al., 1960a; Shiner and Doniach, 1960; Chacko et al., 1961; Cameron et al., 1962; Jos, 1962; Yardley et al, 1962; Bolt, Parrish, French, & Pollard, 1964; Madanagopalan et al, 1965; Stewart et al., 1967; Hamilton, Lynch, and Reilly, 1969, Pollock et al, 1970) mucosae and the difference between the means are small."
<followed by 5 more citations>

8

Write to be read

From an actual article, quoted in Gregory, 1992:

"All of these measurements have wide ranges of values in both control and coeliac mucosae, and the difference between the means are small."

9

Long sentences aren't the problem

Challenge: Find the subject and the verb!

Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone-sensitive NADH-ubiquinone oxido-reductase [hereafter referred to as respiratory chain NADH dehydrogenase or Complex I] from bovine heart, as well as enzyme fractionation studies, have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L, and ND5) encode subunits of Complex I. This is a large complex that also contains many subunits synthesized in the cytoplasm.

(See example and rewrites in Gopen & Swan, 1990)

10

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Recently, however, immunoprecipitation experiments with antibodies to purified, rotenone-sensitive NADH-ubiquinone oxido-reductase [hereafter referred to as respiratory chain NADH dehydrogenase or Complex I] from bovine heart, as well as enzyme fractionation studies, have indicated that six human URF's (that is, URF1, URF2, URF3, URF4, URF4L, and URF5, hereafter referred to as ND1, ND2, ND3, ND4, ND4L, and ND5) encode subunits of Complex I. This is a large complex that also contains many subunits synthesized in the cytoplasm.

(See this example and rewrites in Gopen & Swan, 1990)

11

Working memory is limited! Help your reader chunk information.

Don't front-load your sentences too heavily… Instead, split up lengthy preambles into bite-sized chunks.

From an email to a program officer, asking for advice:

"Although our investigation is at the level of physiological effects on individual coral organisms, since the focus is on reproduction and thus directly links to survival of the population and the reef habitat, and since we are looking at large scale climate effects (temperature and to a lesser extent interactive impacts of widespread hormonally active anthropogenic chemicals) the proposal has population and even ecosystem relevance. For this reason, we are also curious as to whether Biological Oceanography might be appropriate as a second reader of the proposal. We look forward to your comments.

EXERCISE: How would you split this up and rewrite it?

12

Working memory is limited! Help your reader chunk information.

Give appropriate weight to important points.

BEFORE

"The underlying neural correlates of these epigenetic processes are unknown and motivate this proposal."

AFTER

"The underlying neural correlates of these epigenetic processes are unknown. Discovering these correlates is a major motivation for this proposal."

Breaking this into 2 sentences gives each the importance it deserves.

13

Manage your reader's attention

Good writing has direction and momentum.

Note that these two sentences are headed in different directions.

"Lanie, who now walks with the help of braces, had polio as a child."

"Lanie, who had polio as a child, now walks with the help of braces."

(Diana Hacker: "Do not subordinate major ideas")

Short sentence grab attention, especially after a long sentence.

"People like to talk." (in an NSF proposal opening)

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Provide cues about where your paragraph is going.

BEFORE:

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are approximately uniform. Therefore, in first approximation, one may expect that large ruptures of the same fault segment will occur at approximately constant time intervals. If subsequent main shocks have different amounts of slip across the fault, then the recurrence time may vary, and the basic idea of periodic mainshocks must be modified. For great plate boundary ruptures the length and slip often vary by a factor of 2. Along the southern segment of the San Andreas fault the recurrence interval is 145 years with variations of several decades. The smaller the standard deviation of the average recurrence interval, the more specific could be the long term prediction of a future mainshock.

(Example from Gopen & Swan, 1990)

15

Provide cues about where your paragraph is going.

AFTER:

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are roughly uniform. Therefore, nearly constant time intervals (at first approximation) would be expected between large ruptures of the same fault segment. However, the intervals at which earthquakes occur may vary; the basic idea of periodic mainshocks needs to be modified if subsequent mainshocks have different amounts of slip across the fault. In fact, the length and slip of great plate boundary ruptures often vary by a factor of 2. For example, the recurrence period along the southern segment of the San Andreas fault is 145 years with variations of several decades. The smaller the standard deviation of the average recurrence interval, the more specific a long-term prediction about a future mainshock can be.

(Example adapted from Gopen & Swan, 1990)

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Make your writing coherent

- Global coherence (the overall logic and organization of your proposal or paper)
- Local coherence (the ordering or flow of information, within and across sentences)

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Global coherence: Organize your proposal or paper top down, not bottom up

- Foreshadow and recap
- Use topic sentences that reflect each paragraph's "job"
- Provide cues about where the paragraph is going

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Local coherence: Pay attention to information flow and packaging

- Prefer verbs to nouns
- Track given and new information
- Use parallel structure
- Don't be afraid to use pronouns or ellipsis
- Maintain consistent perspective within a sentence: temporal, syntactic, lexical

(don't change perspective without a good reason – this is costly to the reader)

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Given and new information

The given/new "contract" (in English)

(Clark & Haviland, 1977)

- The known or presupposed or backward-linking information (AKA, the topic) goes at the beginning **("Topic position")**
- The important point or new, forward-looking information (or punchline) goes at the end **("Stress position")**

(See also Gopen & Swan, 1990)

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The all-important end of the sentence

Before:

"Understanding the specificity of X in the Y pathway can increase our knowledge of the mechanisms involved in choosing to label certain proteins for destruction among a variety of eukaryotic organisms."

After:

"Understanding the specificity of X in the Y pathway can increase our knowledge of the mechanisms involved in how eukaryotic organisms label certain proteins for **destruction**."

End a sentence with a strong word when possible.
Don't muffle important points with empty verbal flourishes or material that is obvious.

21

Hone your writing

I felt growing anticipation as I tore through the wrapping paper on the present in my lap, hoping it would be the doll I had been asking for for months. It was not; but the microscope I found in its place was more inspiring than the doll I desired could have been.

22

Hone your writing

I felt growing anticipation as I tore through the wrapping paper on the present in my lap, hoping it would be the doll I had been asking for for months. It was not; but the microscope I found in its place was more inspiring than the doll I desired could have been.

I felt growing anticipation as I tore through the wrapping paper, hoping it would be the doll I had wanted for months. It was not; but the microscope I found in its place was more inspiring than any doll.

You can make this more vivid by leaving out obvious details (plus you can save some space).

23

Use parallel structure

"It is unfortunately the norm in this society to expect a boy to be tough, aggressive, and independent, ~~while a girl is expected~~ and to expect a girl to be soft, passive, and dependent."

(Don't change syntactic perspective in the middle of a sentence.)

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24

Use parallel structure

Before:

"Cook (1935) found the percentage gain in the idle hand from practice with the other hand ranges from 60 to 89%, while Siipola (1935) reported a 34% gain from bilateral transfer."

25

25

Use parallel structure

Before:

Don't make authors the topic!

"Cook (1935) found the percentage gain in the idle hand from practice with the other hand ranges from 60 to 89%, while Siipola (1935) reported a 34% gain from bilateral transfer."

These two phrases essentially mean the same thing!

Do you really need this jargon?

vs.

After:

No more jargon!

"Transfer of training occurs from one hand to the other. The extent of this transfer ranges from 34% (Siipola, 1935) to 89% (Cook, 1935)."

Parallel structure makes this easier to understand.

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Use parallel structure

- to highlight contrasts or similarity.
- to provide continuity across sentences, paragraphs, or sections.
- to make condensing easy.

(From "Writing Tricks of the Trade" slides by Michaela Kiernan)

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Use parallel structure

- to help readers identify the new information and integrate it into their mental models, using the given information.

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Use parallel structure

- to achieve impact (without distraction)

"In matters of principle, stand like a rock;
in matters of taste, swim with the current."
- Thomas Jefferson

"This novel is not to be tossed lightly aside,
but to be hurled with great force."
- Dorothy Parker

Examples from Diana Hacker's *A Writer's Reference*

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Don't be afraid of using a pronoun or ellipsis!

Pronouns and ellipses confirm continuity of ideas.

The garbage had to be taken out.
So Bill took the garbage out. -> So Bill took it out.

Nobody else would take the garbage out.
So Bill took the garbage out. -> So Bill did it.

Sometimes full phrases sound wooden—and can actually be harder to process than pronouns or ellipses!

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Don't be afraid of using a pronoun or ellipsis!

The repeated name penalty (Gordon, 1993)

Dan drives an Alfa Romeo.
Dan drives too fast.

This version is slower to read!

vs.

Dan drives an Alfa Romeo.
He drives too fast.

This version is faster; pronouns are cues to what is already in the center of attention.

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Avoid (most) little verbal flourishes

"a sufficient number of"	"enough"
"has the capability to"	"can"
"produced an inhibitory effect"	"inhibited"
"on a theoretical level"	"in theory"
"on a regular basis"	"regularly"

(Adapted from Matthews, J. R. & Matthews, R. W. (2008). Successful Scientific Writing. Cambridge: Cambridge University Press)

(See also Herb Clark's advice on writing)

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Jargon and what to do about it

Jargon defined: ***Precise distinctions packed into efficient labels***

- Avoid jargon unless it's absolutely necessary. (*Sometimes it's necessary!*)
- Choose what you call things very carefully.
  (*You aren't obligated to inherit other people's jargon!*)
- When establishing your own jargon, unpack it - introduce it in expanded form, *not* as a dense, heavy nominal phrase.
  (*After that, you can switch to heavy nominalizations*[1].)
- Be consistent in your terminology! Change terms only with good reason.
  (*There's no such thing as a synonym.*)
- Use (or invent) abbreviations and acronyms sparingly and only when necessary (that is, only when you'll need to use them later).

[1] *Psycholinguistic jargon, LOL*

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Jargon and what to do about it

Unpack jargon the first time you use it.

"When people try to integrate schema-inconsistent information…"

"When people try to integrate information that is inconsistent with the schemas they hold..."

After that, readers will be ready for the jargon phrase *schema-inconsistent information.*

(Example from H. H. Clark)

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Jargon and what to do about it

"The bovine was postoperatively traumatized by a defective electrified fencing enclosure, necessitating euthanatization."

"Positionize the slide carefully to visualize the quite unique spatial configurations with a high degree of accuracy."

"It is the author's opinion that it is not an unjustifiable assumption that this chemotherapeutic agent has the capability of significantly ameliorating and attenuating the symptomology of the disease process."

(Adapted from Matthews & Matthews, 2008)

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Jargon and what to do about it

"After the operation, the cow ran into a defective electric fence and had to be killed."

"Position the slide carefully to see the unique shape clearly."

"I predict that the drug will relieve and curtail disease symptoms."

(Adapted from Matthews & Matthews, 2008)

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Every difference makes a difference! (Dwight Bolinger)

Define your jargon in expanded form before you use it, and don't change terms unless you're making a contrast.

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

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

Digitalis increases the degree to which the mammalian heart can contract. This increased contractility is the result of changes in calcium flux through the muscle cell membrane.

(Examples from Michaela Kiernan's slides, "Writing Tricks of the Trade")

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Writing involves many choices!

Consider: Using common words and straightforward syntax, how many different ways can you express this query:

Who are the programmers
who work for department managers?

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List programmers department managers supervise.
What programmers work for department managers?
List programmers working for department managers.
List programmers who work for department managers.
List any programmers department managers supervise.
List all programmers working for department managers.
Which programmers work for managers of departments?
List all programmers who work for department managers.
List each programmer a department manager supervises.
Which programmers do department managers supervise?
List all programmers that department managers supervise.
List programmers whose supervisors manage departments.
Which of the programmers work for department managers?
Who are the programmers department managers supervise?
List every programmer any department manager supervises.
List every programmer supervised by a department manager.
List programmers with supervisors who manage departments.
Which programmers are supervised by department managers?
Who are the programmers working for department managers?
List programmers whose supervisors are department managers.
List each programmer that any department manager supervises.
List all of the programmers who work for department managers.
Who are the programmers who work for department managers?
List every programmer whom a department manager supervises.
List each programmer who is working for a department manager.
Which programmers are there working for department managers?
Which of the programmers are department managers supervising?
Which of the programmers are working for department managers?
List each of the programmers supervised by a department manager.
List the programmers who are supervised by department managers.
Which of the programmers do managers of departments supervise?
Who are all of the programmers working for department managers?
Which of the programmers are supervised by department managers?
List any programmer whose supervisor is a manager of a department.
Who are all of the programmers that department managers supervise?
Who are the programmers being supervised by department managers?
List any programmers there might be working for department managers.
List everyone who is a programmer supervised by a department manager.
List each of the programmers who is supervised by a department manager.
Which of the programmers are being supervised by department managers?
List any programmer with a supervisor who is the manager of a department.
Who are the programmers whose supervisors are managers of departments?
List all programmers working for supervisors who are managers of departments.
Which of the programmers are being supervised by managers of departments?
List all programmers who work for anyone who is the manager of a department.
List any programmer who has a supervisor who is the manager of a department.
Which of the programmers have supervisors who are managers of departments?
Which of the programmers have supervisors who are the managers of departments?
List each of the programmers who is supervised by anyone managing a department.

"Every difference makes a difference"

(- Dwight Bolinger)

Excerpt from *Variations on a Single Sentence*, the Hewlett Packard Natural Language Project, as cited in Brennan (1990), p. 400.

And on, and on....

39

"The purpose of any scientific article is to convey in the fewest words the ideas, procedures, and conclusions of an investigator. Whether this aim is accomplished depends on how skillful the author is in the language."

(Gregory, 1992)

40

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Choose the right word or phrase

William Safire on metaphors or "word pictures":

"…when somebody 'leaves under a cloud'—that's been used so often that it lost its punch," Safire said. "But when you say someone 'leaves in a hail of dead cats,' all of a sudden, that'll wake somebody up."

(From "Political Columnist William Safire Dies At 79" by David Folkenflik, 9/27/09)

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Choose the right word or phrase

- Some words are high-impact. *Use these for emphasis, but do so judiciously.* (Don't wear out your reader.)
- *Limit your use of intensifiers* (e.g., "*very*", "*extremely*"), as they can dilute the impact of the words around them.
- *Use adjectives sparingly* (for the same reason).
- *Limit your use of rhetorical questions*. (Don't use any that you don't end up answering or at least addressing.)

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Choose the right word or phrase

Do not confuse affect and effect (these are often misused!)

Noun	***Verb***
"It it had that effect, it would negatively affect me." -> Correct!	
"It it had that affect, it would negatively effect me." -> Wrong!	
(feeling)	(cause)

"This is likely to affect the results." -> to change or influence

"This would be likely to effect the results." -> to bring about

"He was without affect" – he showed no emotion

"He was without effects" – his experiment didn't work out!

(or perhaps he didn't have any personal possessions)

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Choose the right word or phrase

Avoid malapropisms, such as:

"We need an energy bill that encourages ~~consumption~~ conservation." *(GWB)*

"We cannot let terrorists and rogue nations hold this nation ~~hostile~~ hostage." *(GWB)*

"Republicans understand the importance of ~~bondage~~ bonding between a mother and child." *(DQ)*

"...computationally ~~intense~~ intensive datasets" *(my anonymous colleague)*

"...identify ~~optimum~~ optimal solutions" *(ditto)*

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Avoid inadvertent puns

"To my delight I was funded to work full time for eight weeks. My mentor had other projects and responsibilities that summer, so I was given considerable freedom in planning field and lab work. I became completely absorbed by the lake and I wanted to understand everything about it, both past and present."

Reword!!

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Avoid ambiguous or *garden-path sentences

**(ambiguous sentences that can be misread and then need to be re-read)*

"This is a good way to keep people engaged in criminal activities off the streets."

"My clinical interests grew through the opportunities I had to spend time working with several different clinical populations"

"Observations of teachers are very helpful in programming."

47

Avoid ambiguous or *garden-path sentences

**(ambiguous sentences that can be misread and then have to be re-read)*

"These disorders all involve dysfunction in affect or impulsivity and candidate gene polymorphisms, i.e., genes that vary in their molecular structure, have been identified that confer individual differences in affect or impulsivity."

48

Avoid ambiguous or *garden-path sentences

*(ambiguous sentences that can be misread and then have to be re-read)

"These disorders all involve dysfunction in affect or impulsivity and candidate gene polymorphisms, i.e., genes that vary in their molecular structure, have been identified that confer individual differences in affect or impulsivity."

"These disorders all involve dysfunction in affect or impulsivity. Candidate gene polymorphisms (i.e., genes that vary in their molecular structure) have been identified that confer individual differences in affect or impulsivity."

"These disorders all involve dysfunction in affect or impulsivity. Individual differences in affect or impulsivity may be associated with gene polymorphisms (i.e., genes that vary in their molecular structure).

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Restrictive vs. non-restrictive modifiers

"Americans who are patriotic revere the flag."

"Americans, who are patriotic, revere the flag."

These sentences mean very different things.
When in doubt, use *that* rather than *which.*

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That vs. which

That is restrictive; *which* is not (and should be preceded by a comma).

"This trend is due to gender stereotypes that claim that boys are tough, while girls are fragile."

"This trend is due to gender stereotypes, which claim that boys are tough, while girls are fragile."

These sentences mean very different things.
When in doubt, use *that* rather than *which.*

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Only and scope

Only Pat is sad because the Prime Minister is ill.	(no one else is the least bit sorry)
Only, Pat is sad because the Prime Minister is ill.	(here, *only* is used as a conjunction, like *but* or *except that*.)
Pat is only sad because the Prime Minister is ill.	(Pat is feeling no other emotion)
Pat is sad only because the Prime Minister is ill.	(for no other reason)
Pat is sad because only the Prime Minister is ill.	(and not the whole of Parliament)
Pat is sad because the only Prime Minister is ill.	(the one and only Prime Minister. Would Pat would be happier about the illness if there were more Prime Ministers?)
Pat is sad because the Prime Minister is only ill.	(as opposed to dead)

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If English isn't your first language…

- Develop your own awareness of how your first language can lead to issues in your second language.
- Common problems for L2 learners:

  Determiners: *a* vs. *the*

  Prepositions are difficult (not rule-based, but wildly idiomatic)
  - "Put it ~~to~~ the table"
  - "Go ~~to~~ home"
  - "I'm ~~by/in~~ home"
  - "Put it on the table."
  - "Go home"
  - "I'm at home"

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If English IS your first language, consider…

Everyone has writing issues! Discover what yours are.
Here are some common ones:

- "Lasers ~~only~~ only destroy the target, leaving the surrounding healthy tissue intact."
- "Upon entering the doctor's office, a skeleton caught my attention."
- "~~Less~~ Fewer people get funded on their first try than on their second."
- "It's true that a bear will defend it~~s~~ its cub."
- "He must ~~of~~ have arrived earlier."

(First 2 examples are from Diana Hacker's book)

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Beware of editing mishaps

- Be sure to check your given-new structure after rearranging sentences or paragraphs.
  - Read the relevant text straight through with a fresh eye (don't introduce something as new if it's already mentioned).
  - Make sure you don't repeat material you don't mean to.
- Avoid *fractal writing! **(my term)*
  - Resist the impulse to start decorating your prose with extra phrases or unnecessary adjectives.
  - Don't ruin the lovely linear flow you may have achieved.
  - Fractal writing introduces redundancy. It wears your reader out and makes them start skimming; they will miss important points.
- Check for missing words due to cut-and-paste errors.

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Strategic writing for proposals and papers

- Say what you're *not* doing (provide disclaimers).
- Acknowledge what is risky and highlight what is innovative.
- Try to do the reviewers' job for them.
- Be strategic in your citations.
- Try reading your prose out loud.
- Ask others to read your proposal!
  - "After 20 years of grant writing, I can still produce wordy, unfocused first drafts...a grant-savvy scientist in another discipline is best qualified to catch fuzzy writing and jargon." *(Janet Rasey)*
  - "Give working drafts of your application to colleagues who work outside your specific area of research… areas of your application that are difficult for them to understand are likely to be trouble spots for reviewers too." *(Otto Yang, p. 23)*
  - Recruit 3 "pre-reviewers" to read your second draft: An expert in your scientific field to check for accuracy, a non-expert scientist to check for clarity, and a good editor to help you polish your proposal. *(Liane Reif-Lehrer)*

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One more strategic example: Being specific makes your plan more convincing

(From the GRFP application of a graduate student in a bio field, discussing Broader Impacts)

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End of Research Statement

Broader Impacts: Undergraduate students from Stony Brook University will be involved in fish rearing, growth measurements, and data analysis. Preference will be given to students from underrepresented and economically disadvantaged groups, which make up around 23% of the undergraduate population at Stony Brook.

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Comments

Broader Impacts: Undergraduate students from Stony Brook University will be involved in fish rearing, growth measurements, and data analysis. Preference will be given to students from underrepresented and economically disadvantaged groups, which make up around 23% of the undergraduate population at Stony Brook.

This sounds like boilerplate.

It's great to talk about SBU's diversity, but say more about how you will take an active role here (avoid passive distant phrases like "will be involved..." or "preference will be given..." That's too vague.

Also, you don't recruit folks by giving them "preference" - you have to go out and find them, get their attention and interest, and encourage them to apply. Here on campus we have several outstanding organizations to help with this - CIE, WISE, etc.

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Furthermore, my research deals with climate change and cultural eutrophication, which provides an easily accessible example to illustrate these concepts to urban youth. I plan to use this project in youth education programs I develop as part of my outreach activities at the American Museum of Natural History in New York City.

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Comments

Furthermore, my research deals with climate change and cultural eutrophication, which provides an easily accessible example to illustrate these concepts to urban youth. I plan to use this project in youth education programs I develop as part of my outreach activities at the American Museum of Natural History in New York City.

Earlier you illustrated but didn't directly define this concept - define it here (e.g., "cultural eutrophication, or what happens when humans cause substances to be added to an ecosystem." (If you leave a reviewer puzzled at this point, they will doubt your ability to communicate with urban youth!).

61

Comments

Furthermore, my research deals with climate change and cultural eutrophication, which provides an easily accessible example to illustrate these concepts to urban youth. I plan to use this project in youth education programs I develop as part of my outreach activities at the American Museum of Natural History in New York City.

Earlier you illustrated but didn't directly define this concept - define it here (e.g., "cultural eutrophication, or what happens when humans cause substances to be added to an ecosystem." (If you leave a reviewer puzzled at this point, they will doubt your ability to communicate with urban youth!).

Rewrite in a more active form. Strengthen this important final paragraph by providing an example(s) if you can, and also refer to your personal statement. This is another good time to tie in with your lovely theme about bringing nature to city kids.

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Final version (end of Research Statement)

- **Broader Impacts:** Stony Brook University's Center for Inclusive Education (CIE) contains many programs directed at increasing participation from underrepresented groups in STEM disciplines, including NSF's Opportunities for Enhancing Diversity in the GeoSciences program. Through the CIE, I will actively seek out students from underrepresented or high needs areas to involve in my research. Students can assist with fish rearing and data collection and analysis. I will also encourage and mentor CIE students to use aspects of my project as the basis for their undergraduate honors thesis. Furthermore, this research provides an easily accessible example to illustrate how humans are altering the environment via climate change and nutrient pollution to urban youth. I will use this project in youth education programs I develop as part of my outreach activities at the American Museum of Natural History.

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Common mistakes to avoid making:

- Too little detail (consider your audience!)
- Too much detail (ditto!)
- Poor organization
- Lack of objectivity (be even-handed, never glib)
- Incoherence
- Hiding problems
- Promising what you don't deliver
- Not planning for unexpected occurrences
- Failing to cite essential literature

(adapted from Yang, 2005)

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Resources for clear and lively scientific writing:

- Everyone can write better (and you are no exception!) (H. H. Clark)
- *The science of scientific writing.* Gopen, G. D., & Swan, J. A. (1990). American Scientist, 78, 550–558
- Dancing with Professors: The trouble with academic prose (P. N. Limerick)
- The infectiousness of pompous prose (M. W. Gregory, 1992). Nature 360, 11–12
- Slides from "Writing Tricks of the Trade" presentation by M. Kiernan
- Successful Scientific Writing (Matthews, J. R. & Matthews, R. W., 2008). Cambridge: Cambridge University Press
- *A Writer's Handbook* (D. Hacker)
- *Guide to Effective Grant Writing: How to Write a Successful NIH Grant Application (Yang, 2005; revised edition, 2012)*
- Grant Application Writer's Handbook, 4th Ed. (L. Reif-Lehrer, 2005)
- *Dreyer's English: An Utterly Correct Guide to Clarity and Style* (B. Dreyer, 2019)

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and finally…

Good luck!

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