Key Components of Scientific Writing

(1). Effective scientific communication ***tells a story*** (see Lecture 4)

Your ***introduction*** sets the stage and introduces the "tension" in the story, i.e., the clearly defined open question

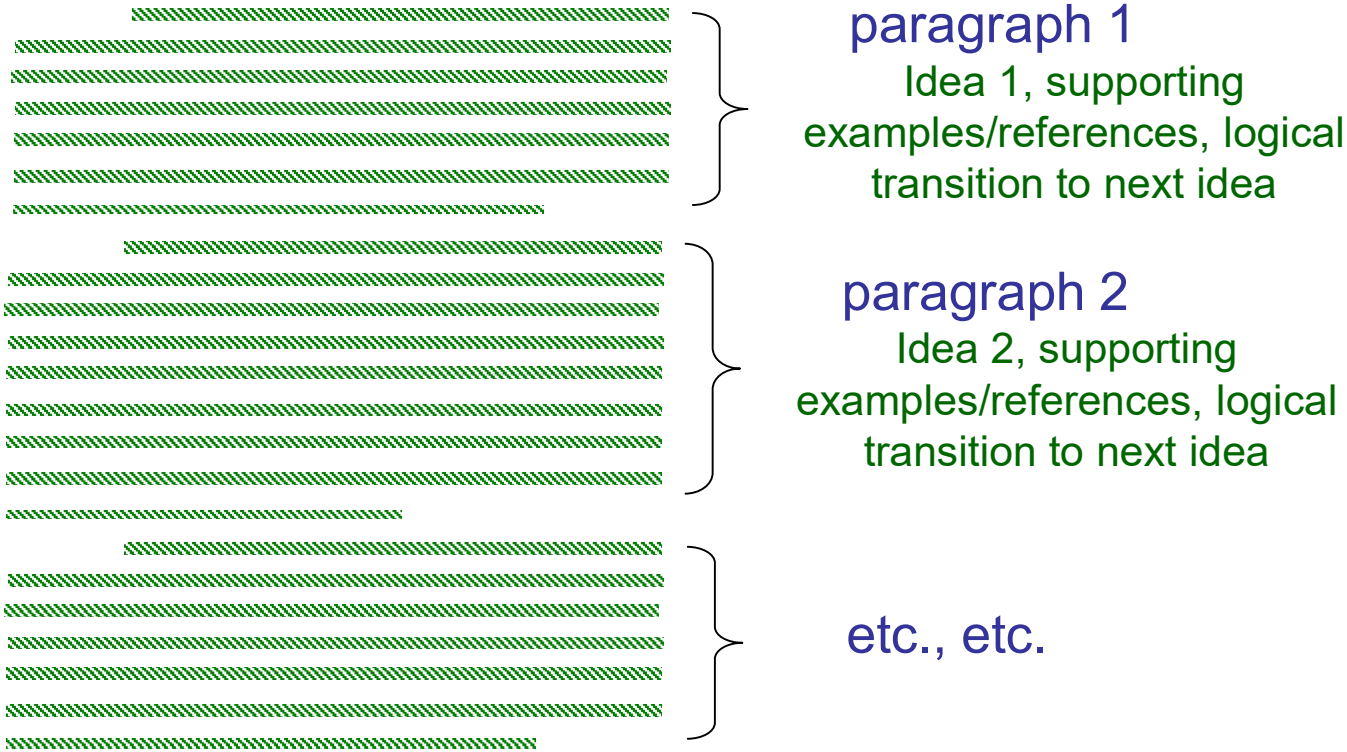
Your ***methods and results*** describe the tools used and results obtained in your efforts to answer the open question in the story

Your ***conclusions*** close the loop in the story by summarizing resolution of the open question in your story that was raised in the introduction

(2). Effective scientific communication is ***logically structured***

Start with an outline and use paragraphs to maintain a logical structure (see WW #1)

Every paragraph should contain roughly one idea + supporting evidence for that idea, if possible, and ***this idea should be presented as concisely as possible***



(3). Effective science communication is ***concise***

Avoid unnecessary background information: Ask yourself, "Do I really need this extra sentence, paragraph, or clause to explain my results or main point?"

Writing from a well-organized outline will help you avoid adding extraneous information

Keep sentences short: (see WW #2) Avoid lengthy and complex sentences (>25 words with long strings of modifiers). Ideally, each sentence contains one idea

To write concisely, it is easier to start by writing short sentences that convey single ideas than to start with complex prose that you have to trim!

Non-Concise Terms and Their Replacements

A	
Actually	[Nothing; just cut] *
Accordingly	*So or Thus*
Afford an opportunity to	*Permit or Allow*
Am in the receipt of	Received
Are + gerund, e.g. Are planning Are showing	Make gerund the verb, e.g. Plan Show
Are able to + verb, e.g. Able to write Able to reset	Can + verb, e.g. Can write Can reset
Are capable of + gerund, e.g. Are capable of showing Are capable of reporting	Make the gerund the verb, e.g. Show Report
Arrive at/Come to a decision	Decide
Arrive at/Come to an agreement	Agree
At a later moment/date/time	*Later or [specific time frame]*
At present At this point in time In this day and age"	Now
Attend a meeting	Meet
B	
Business jargon, e.g. Back of the envelope Forward planning Low hanging fruit Human capital	Use plain language, e.g. Initial estimate Planning Easy tasks *or* Quick steps Employees *or* People
Came to the conclusion	*By or With*
C	
Came to the conclusion	Concluded or decided
Clearly	[Nothing; just cut] *
Can be of assistance	Can help
Conduct an investigation of	*Investigate or Study*
Consider + noun derived from a verb, e.g. Consider implementation Consider investigation	Verb form of the noun, e.g. Implement Investigate
Contact by phone	Call

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Non-Concise Terms and Their Replacements

D	
During the course of During the process of	During
E	
An example of this is the fact that	For example
F	
Few and far between	Few ** Rare
Fewer in number *(Note: It's never "less in number," because you don't use less with countable nouns!)*	Fewer
Fill completely	Fill
First and foremost	First **
For the purpose of	For *or* to
For the reason that Due to the fact that In light of the fact that Because of the way that	Because or As
G	
Going forward Moving forward	[Cut whole thing; just start with whatever comes after the phrase]
H	
Has been shown to	[Cut the whole thing, really!]
Has the ability to	Can
Has the potential to	May
Have a meeting Hold a meeting	Meet

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Non-Concise Terms and Their Replacements

I	
I believe	[Cut the whole thing]
I feel	[Cut the whole thing]
I think	[Cut the whole thing]
I would like to request that	Please
In an effort to	To
In consideration of	Considering
In excess of	More than
In order to	To
In regards to	Regarding *or* About
In the case of In the event that	For *or* With If
In the last decade	Since [year] *(N.B. This version also ages more accurately.)*
In the vicinity of In the proximity of	Near
In the year 2018	In 2018
Interestingly	[Nothing; just cut] *
Is applicable to	Applies ***
Is in attendance	Attends ***
Is in violation	Violates ***
Is of the opinion	Thinks ***
Is prepared to [verb], e.g. Is prepared to review Is prepared to analyze	Will [verb] *** Will review Will analyze
It has been decided that	[Cut whole thing; just start with whatever comes after the phrase]
It is evident that It is clear that It is obvious that	[Cut whole thing; just start with whatever comes after the phrase]
J	
Join together	Join

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Non-Concise Terms and Their Replacements

K	
L	
Lacked the ability to	Could not
Last but not least	Last *or* Finally
M	
Make adjustments/changes	Adjust *or* Change
Make contact with	Contact
Make revisions	Revise *or* Change
Moreover	Also
N	
Needless to say	[Cut completely]
O	
Obviously It is obvious that	[Nothing, just cut—you never want to insult your reader!] *
On a daily basis On a weekly basis On a monthly basis On an annual/yearly basis	Daily Weekly Monthly Annually/Yearly
Over the course of	In *or* During
P	
Phrasal verbs (verb + preposition), e.g. Look in to Blowing up	Action verb, e.g. Investigate *or* Research Explode
Plain and simple	Simple **
Plan ahead Planned in advance	Plan Planned
Q	
R	
Realistically	[Nothing; just cut] *
Really	[Nothing; just cut] *

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Non-Concise Terms and Their Replacements

S	
Similar to	Like
Strikingly	[Nothing; just cut] *
Surprisingly	[Nothing; just cut] *
T	
The extent to which	How (much)
The question as to whether	Whether
The question as to which	Which
The way in which	How
U	
V	
Various	[Nothing; just cut]
Very	[Nothing; just cut] *
W	
Was/were able to Was/were not able to	Could Could not
With the exception of	Except for
X	
Y	
Z	

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(4). Effective science communication is ***precise***

Avoid subjective statements:

"We felt that the diffractometer was misaligned, because we were unable to observe the Bragg peak,"

is more appropriately written,

"The Bragg peak was not observed, suggesting a problem with the sample or the diffractometer's alignment."

Avoid useless adjectives and quantify:

"We observed an incredibly large increase in scattering intensity when the temperature was lowered,"

is more appropriately written,

"There was a three-fold increase in resonance A's scattering intensity when the temperature was lowered below the transition,"

(4). Effective science communication is ***precise*** (cont.)

Don't use ambiguous pronouns: Avoid vague pronouns like "it", "this", "that", etc.

"Bob wanted to help John measure the resistance of the sample in the laboratory, but he couldn't find it."

What does "it" refer to in this sentence? Who is "he"?

Don't anthropomorphize: Most of the things you will probably study in your careers will not have either feelings or free will, so avoid statements like,

"The myosin wants to move along the actin protein strand…"

Be specific about the mechanisms causing the phenomena you describe: inanimate objects don't "want" or "need" anything

(5). Effective science communication is ***compelling***

Minimize use of weak verb phrases: (see WW #3) These are dull and tend to unnecessarily lengthen sentences.

"The Acton 800 spectrometer is equipped with two stages, the first of which is known as the filter stage, and the second of which is known as the dispersive stage," (30 words)

is more succinctly written,

"The Acton 800 spectrometer has both filter and dispersive stages." (10 words)

Other Weak verb phrases	Strong verbs
"made a determination"	determined
"performed a measurement"	measured
"conducted an analysis"	analyzed

See Celia's lecture on verb usage:
http://people.physics.illinois.edu/Celia/Lectures/Verbs.pdf

(5). Effective science communication is ***compelling*** (cont.)

Place verbs early in sentences: (see WW #3) Let the reader know early what the action in the sentence is.

"*Scaling functions for both gauge-invariant and non-gauge invariant quantities across topological transitions of noninteracting fermions driven by the non-Abelian gauge potentials on an optical lattice have also been derived.*"

is better written,

"*Scaling functions were derived for both gauge-invariant and non-gauge invariant quantities across topological transitions of noninteracting fermions driven by the non-Abelian gauge potentials on an optical lattice.*"

See Celia's lecture on verb usage:
http://people.physics.illinois.edu/Celia/Lectures/Verbs.pdf

(6). Effective science communication is ***clear***

Write simply and clearly! Avoid colloquial phrases, technical jargon, slang words and phrases, and complex words

Jargon terms confuse the reader and disrupt the logical flow of your paper

Employ "parallel structure" when listing things to help the reader navigate complex sentences…Think writing computer code!

"My goals in this class are to learn how to write more effectively, expressing myself better in presentations, and the scientific proposal review process"

(6). Effective science communication is ***clear*** (cont.)

Using the same verb form in a complex sentence helps the reader navigate a complex sentence with multiple elements: (Verb/Gerund focus)

"My goals in this class are

- to learn how to write more effectively,
- to express myself better in presentations, and
- to understand the scientific proposal review process"

OR

"By taking this class, I am interested in

- learning how to write more effectively,
- expressing myself better in presentations, and
- understanding the scientific proposal review process"

(6). Effective science communication is ***clear*** (cont.)

Using the same verb form in a complex sentence helps the reader navigate a complex sentence with multiple elements: (Noun phrase focus)

"My goals in this class are

- more effective writing,
- better presentation skills, and
- review of scientific proposals"

(7). Effective science communication is ***clear*** (cont.)

Avoid misplaced modifiers…position the modifier near the word/phrase it's modifying:

"I discussed how to align the laser on the optical table with my adviser."

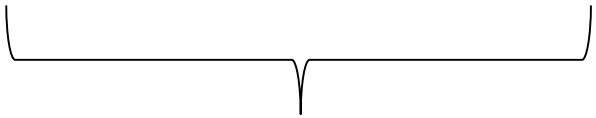
Fixed:

"I discussed with my adviser how to align the laser on the optical table."

"Which" vs "That"

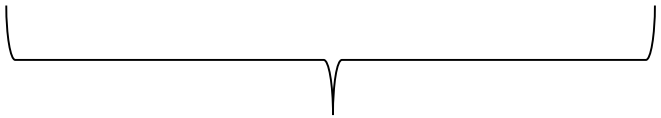
Use "that" to specify a specific class of something ("that" clauses are "restrictive clauses"):

"The books that have a red cover are new"



Use "which" (followed by a comma) to provide additional information about something ("which" clauses are "nonrestrictive" clauses):

"The books, which have a red cover, are new"



“Using” vs “by”

Be careful of interchanging “using” and “by”

“The transport properties of the device were measured by a standard voltmeter connected to a lock-in amplifer”

Is the inanimate voltmeter making the measurement?

“The transport properties of the device were measured using a standard voltmeter connected to a lock-in amplifier”

“Allow” vs “Allow for”

Be careful of interchanging “allow” and “allow for”

To “allow” something is to “permit” something to happen

To “allow for” something is to “plan for” or “anticipate” something that might happen

“I will ***allow*** you to leave work to ***allow for*** the possibility that there will be heavy traffic”