



# How to Write a Paragraph

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This short talk will show you how to write coherent scientific papers by putting together logically organized, concise paragraphs.

**Suppose you want to write the  
introduction for a paper about NASA's  
Solar Dynamics Observatory (SDO)**



*Courtesy NASA*

## **First, make an outline of main ideas**

- ✓ **The sun is the source of all space weather, but its physical processes are poorly understood.**
  - ✓ **The NASA Solar Dynamics Observatory (SDO) was launched in 2010 to study the solar corona...**
  - ✓ **One component of SDO is the Atmospheric Imaging Assembly (AIA), a suite of four telescopes.**
  - ✓ **The AIA is composed of highly reflective multi-layer mirrors.**
  - ✓ **Mirrors image the sun at all seven euv wavelengths.**
- ...and check to see if the ideas are presented in a logical order (tell a story)**

Never write ANYTHING without first outlining your main ideas. I recommend writing full sentences, instead of just words or short phrases, to get a better idea of what you want to say.


Make your sentences as specific as possible. The purpose of the sentence outline is to help you spot missing or superfluous material. If your sentences are vague and general, you'll lose the main advantage of sentence outlining.

If you have two sentences that say about the same thing, eliminate one of them, combine them, or differentiate them.

Ideally in science writing, the narrative should flow logically and incrementally from Point A to Point B to Point C to the conclusions. If your outline does not reveal a logical progression of ideas, move things around until it does.

**Each sentence in your outline becomes the “topic” sentence for a paragraph**

**The sun is the source of all space weather, but its physical processes are poorly understood.**



**<You put a paragraph here>**

**The Solar Dynamics Observatory was launched by NASA in 2010 to study the solar corona, specifically coronal mass ejections, which are known to affect space weather.**

Your main points provide a framework for your narrative. They become the topic sentence for a paragraph.

The purpose of **every additional word** that you put in a paragraph should be to support and explain the topic statement and move the reader logically and incrementally to the next topic statement.

**Celia’s foolproof, four-step SEeeES\*  
method to crank out science writing:**

- 1. Put the topic sentence first**
- 2. Explain it, expand it, give evidence for it**
- 3. Give an example of it**
- 4. Summarize it in a way that leads  
logically to the next topic sentence**

**Expand  
\*State → Explain → Exemplify → Summarize  
Evidence**

**Tip: Use the same construction paradigm for paragraphs,  
subsections, and sections of a scientific paper**

One of the key advantages of this method is its scalability—you can use it for short papers, theses, talks, posters—for any audience.

So let’s go back to our first two topic sentences from our outline:

“The Sun is the source of all space weather...”

and

“The Solar Dynamics Observatory was launched by NASA in 2010...”

and run them through the paragraph cranker-outer...

## 1. Topic sentence goes first

**The sun is the source of all space weather, but its physical processes are poorly understood.**

**The Solar Dynamics Observatory was launched by NASA in 2010 to study the solar corona, specifically coronal mass ejections, which are known to affect space weather.**



In science writing, the topic sentence is almost always the first sentence of the paragraph. While literary writing might put the topic sentence last, to build suspense, or in the middle, to redirect a reader's attention, put the topic sentence first in your paragraphs to emphasize your important points and reinforce the logical structure of your arguments.

Readers pay the most attention at the beginning of chunks of text. Exploit this natural human tendency by putting your topic sentences in the places where people are most likely to recognize and remember them—as the first sentence of each new paragraph.

## 2. Explain it

The sun is the source of all “space weather,” but its physical processes are poorly understood.

**Space weather refers to conditions on the sun and in the solar wind, magnetosphere, ionosphere, and thermosphere of Earth. These conditions affect the performance and reliability of space and terrestrial systems and can endanger life and health.**

**The Solar Dynamics Observatory was launched by NASA in 2010 to study the solar corona, specifically coronal mass ejections, which are known to affect space weather.**

In the next sentence(s), explain, expand on, or provide supporting evidence for the ideas conveyed in the topic sentence.

In the SEES method, this first *E* can stand for three things: explanation, expansion, evidence.



### 3. Give an example

The sun is the source of all “space weather,” but its physical processes are poorly understood. Space weather refers to conditions on the sun and in the solar wind, magnetosphere, ionosphere, and thermosphere of Earth. These conditions affect the performance and reliability of space and terrestrial systems and can endanger life and health. **For example, a coronal mass ejection, the solar equivalent of a hurricane, can disrupt telecommunications systems on Earth.**

**The Solar Dynamics Observatory was launched by NASA in 2010 to study the solar corona, specifically coronal mass ejections, which are known to affect space weather.**

Your explanation will often include illustrative examples. Put them next.

Note how the writer has used a familiar example from terrestrial weather, a hurricane, to reinforce the idea of space weather and to explain the unfamiliar concept of “coronal mass ejection.”



## 4. Summarize and transition

The sun is the source of all “space weather,” but its physical processes are poorly understood. Space weather refers to conditions on the sun and in the solar wind, magnetosphere, ionosphere, and thermosphere of Earth. These conditions affect the performance and reliability of space and terrestrial systems and can endanger life and health. For example, a coronal mass ejection, the solar equivalent of a hurricane, can disrupt telecommunications systems on Earth. **Solar research is needed to understand solar processes and predict space weather.**

**The Solar Dynamics Observatory was launched by NASA in 2010 to study the solar corona, specifically coronal mass ejections, which are known to affect space weather.**

Finally, add a transitional sentence that sums up this paragraph and leads the reader logically to the next topic sentence.

In this example, the fourth sentence repeats the ideas of “space weather” and “not currently understood” that are introduced in the topic sentence and sets the stage for the next paragraph, which explains what the SDO is, what kind of research it is designed to do, and how it is addressing the problem of space weather. ***Thus the two paragraphs are linked structurally by the evolution of the ideas and explanations that they present.***

## Paragraph equation:

$$1 S_t = 1 \text{ ¶}, \quad [1]$$

where  $S_t$  is a topic sentence, and ¶ is a paragraph

**Don't put more than one topic sentence in a paragraph**

**Don't put anything in a paragraph that doesn't explain, support, exemplify, or summarize the topic sentence**

**Write shorter paragraphs (<8 sentences)**

**Write from an outline!**



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No superfluous “stuff” in a paragraph. If it is not directly related to the topic sentence, delete it or move it to its own paragraph.

In fact, no superfluous stuff anywhere!  
(q.v. <http://people.physics.illinois.edu/Celia/Lectures/Fluff.pdf>)

To learn more about the Solar Dynamics Observatory (SDO), see <http://sdo.gsfc.nasa.gov/>.

To learn more about how the SDO's extreme ultraviolet (euv) telescopes were constructed, see <https://str.llnl.gov/JanFeb11/soufli.html>.