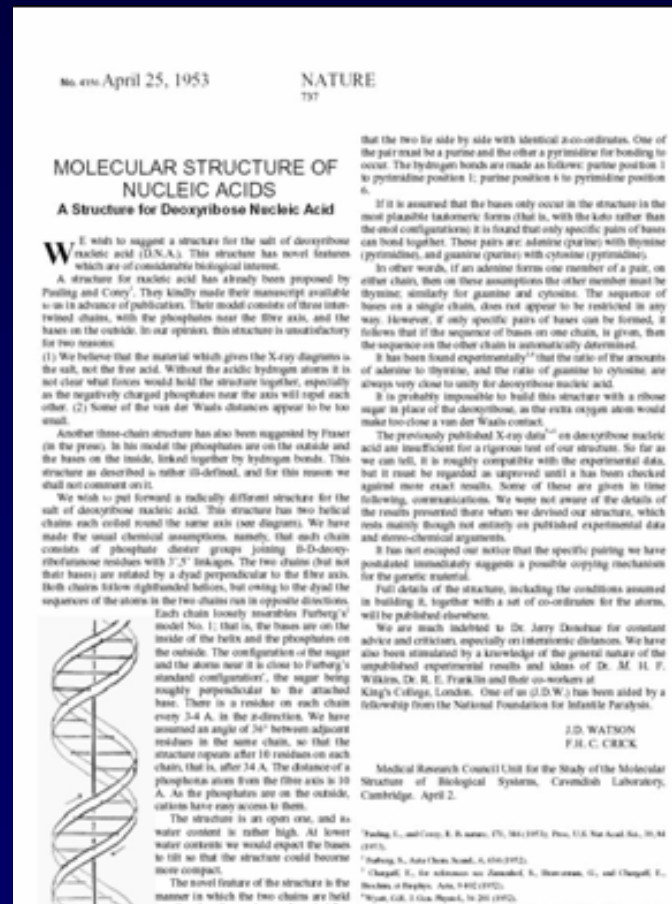


# The Craft of Scientific Writing

Michael Alley  
College of Engineering  
Pennsylvania State University



audience

purpose

occasion

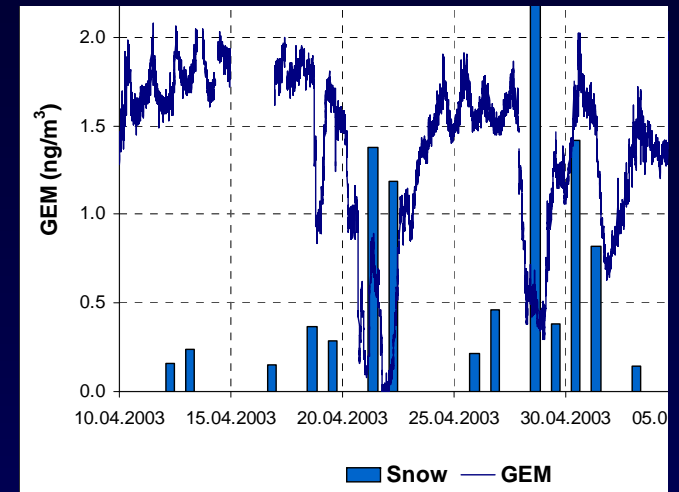
PENNSTATE



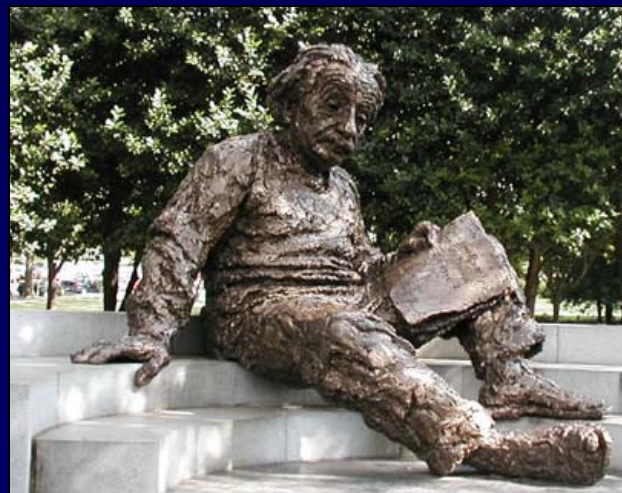
# This talk focuses on style, which is the way that you express the ideas of your work



Structure



Illustration



Language

**A key for successful scientific writing is effectively structuring the document**

**How much detail  
to give**

**How to  
organize**

**Where to begin?**

[Martin, 1999]

# A strong title orients the audience to the work

**10 MWe Solar Thermal  
Central Receiver  
Barstow Power Pilot Plant  
Conversion Study**



# **A strong title orients the audience to the work**

**10 MWe Solar Thermal  
Central Receiver  
Barstow Power Pilot Plant  
Conversion Study**



**Proposal to Select a  
New Heat Transfer Fluid for  
the Solar One Power Plant**

**With unfamiliar topics, an effective opening is to orient with background information**

## **Design of Steam Generators for the Downhole Portion of Oil Wells**

**Sandia National Laboratories**

**More than half of the oil in a reservoir is too viscous to pump out with conventional methods. By heating these oils with steam and decreasing their viscosity, we can recover billions of gallons. For oils below 800 meters, though, the steam produced on the surface loses too much energy in transit to heat the oil. We are developing a downhole steam generator to apply hot steam directly.**

# Illustrations have to be properly introduced

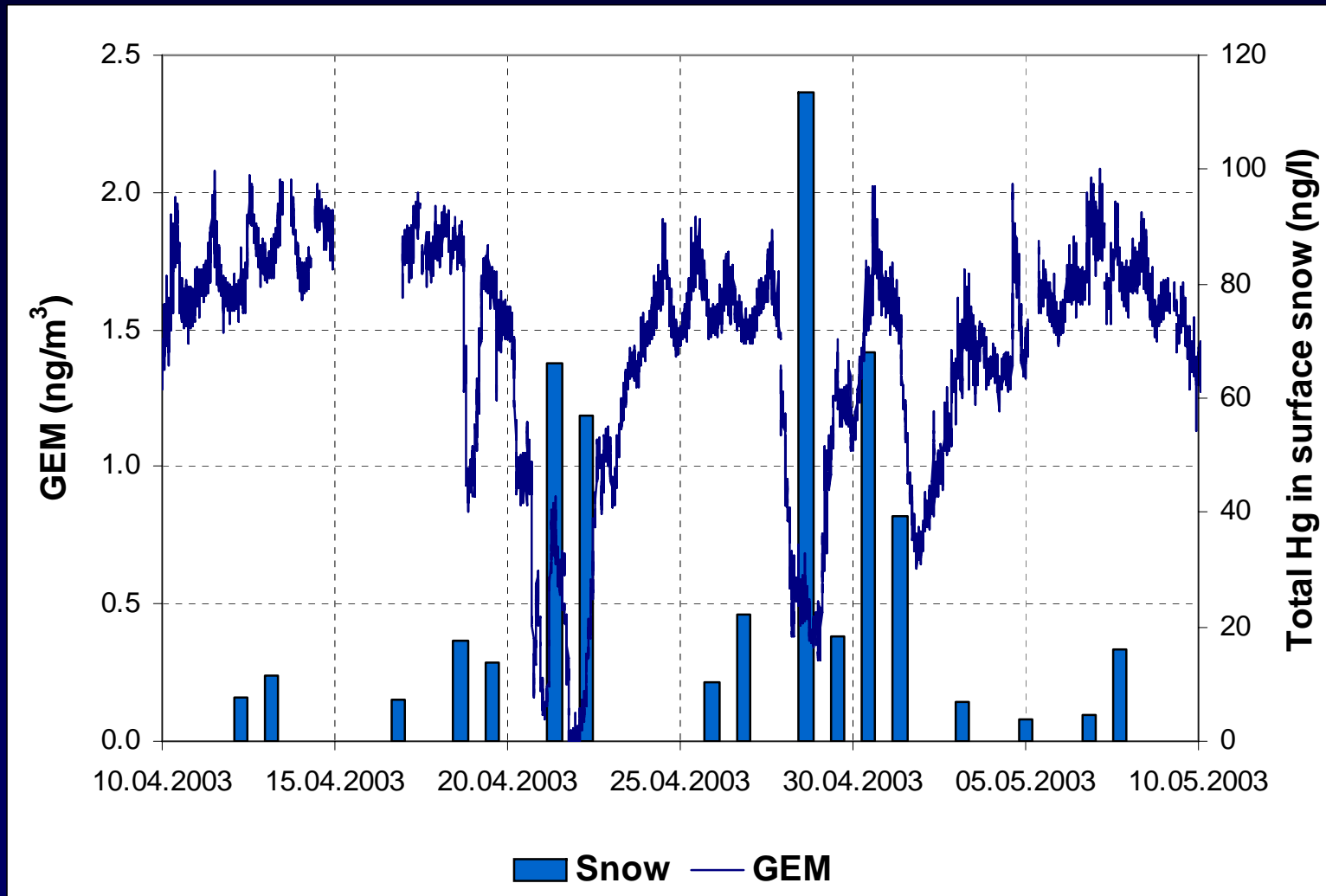


Figure 1. Gaseous elemental mercury in the atmosphere and surface snow levels of mercury versus time [Aspmo et al., 2004].

# For successful language in scientific writing, you have to balance precision with clarity

Being  
Precise

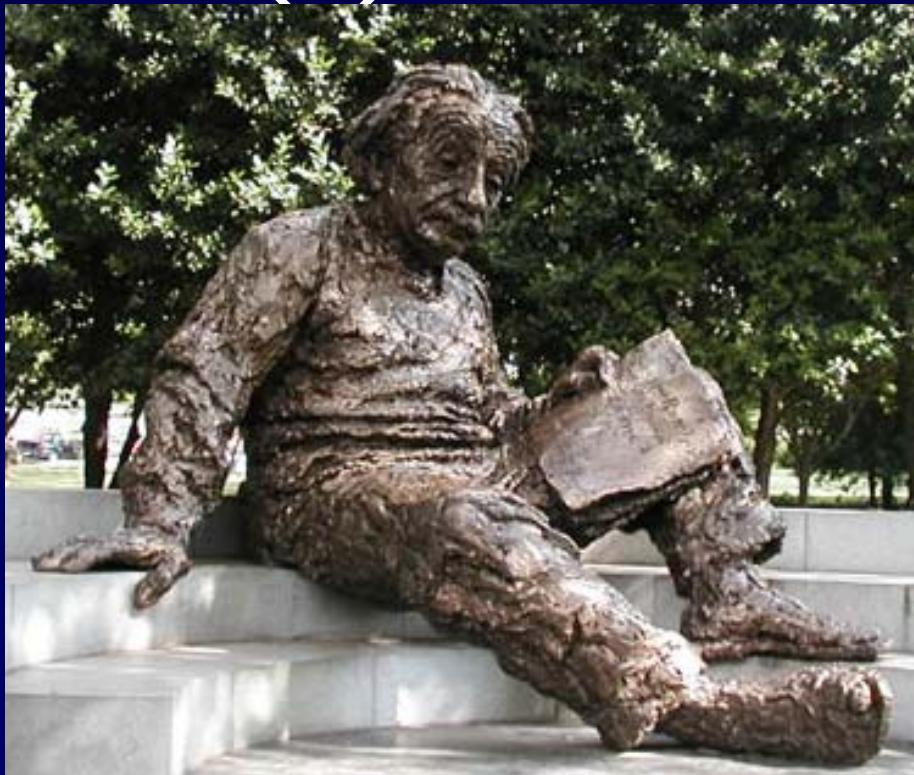
Being Clear

Needless complexity:

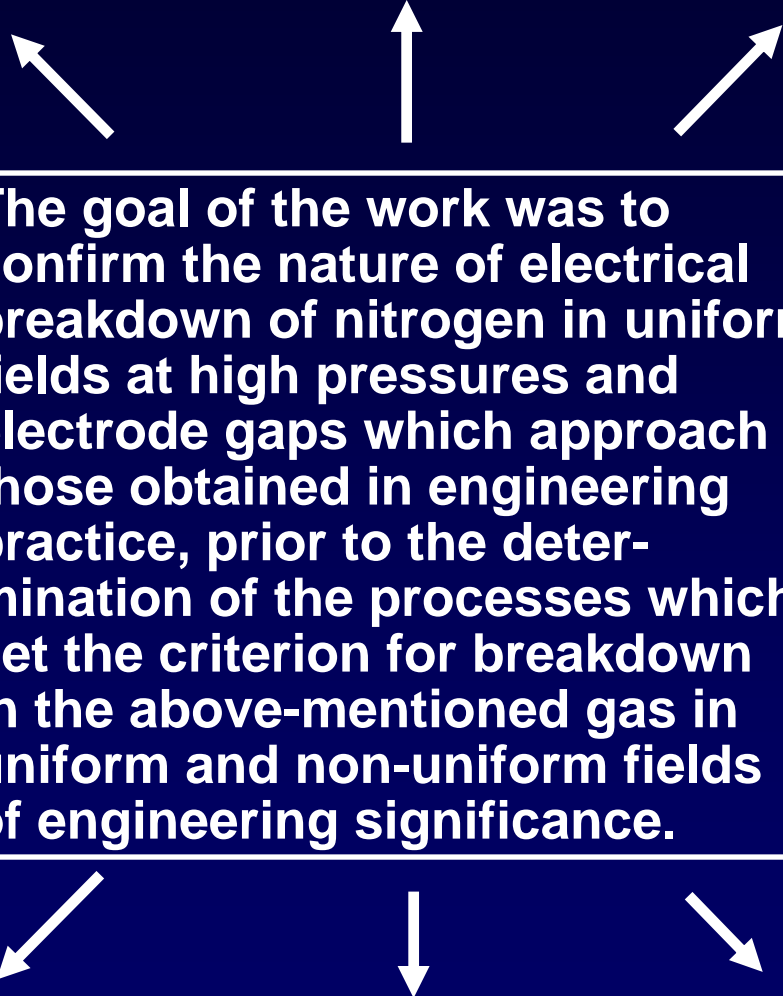
*facilitate, operationability*

*e.g., and/or, RESULT*

*gate valve system test setup*

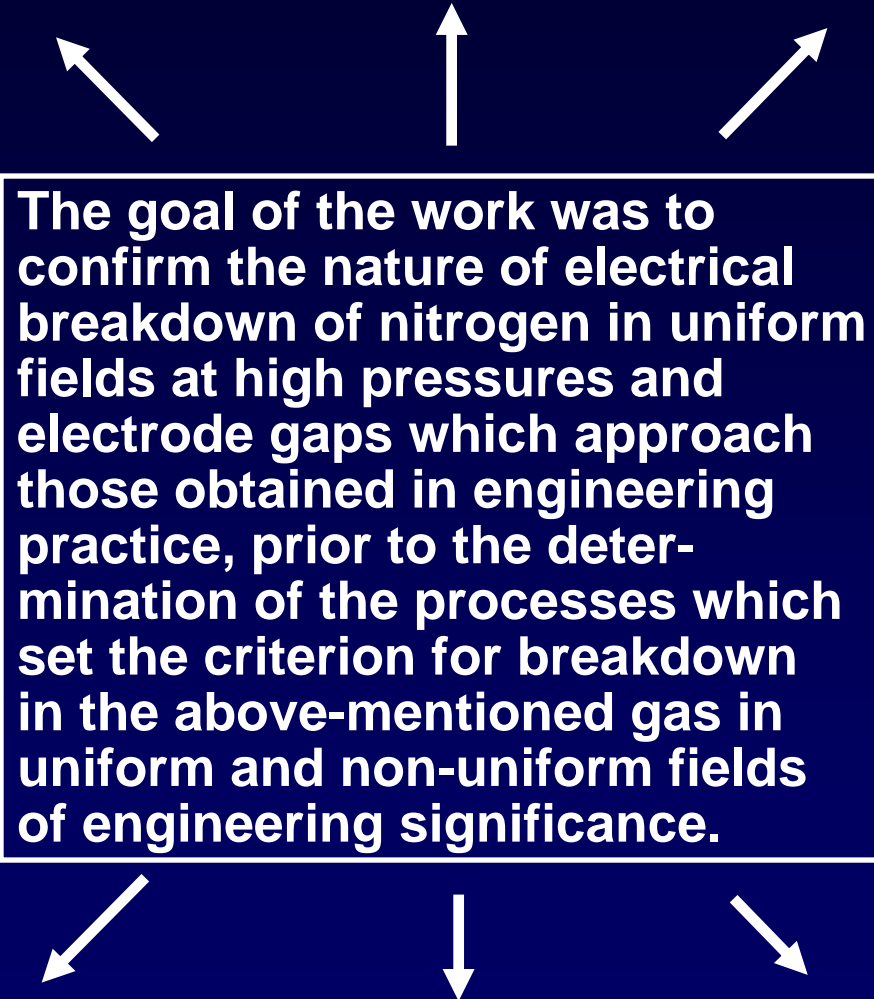


# Needlessly complex sentences misdirect readers




The goal of the work was to confirm the nature of electrical breakdown of nitrogen in uniform fields at high pressures and electrode gaps which approach those obtained in engineering practice, prior to the determination of the processes which set the criterion for breakdown in the above-mentioned gas in uniform and non-uniform fields of engineering significance.

# Needlessly complex sentences misdirect readers



The goal of the work was to confirm the nature of electrical breakdown of nitrogen in uniform fields at high pressures and electrode gaps which approach those obtained in engineering practice, prior to the determination of the processes which set the criterion for breakdown in the above-mentioned gas in uniform and non-uniform fields of engineering significance.

At high pressures (760 torr) and typical electrode gap distances (1 mm), the electrical breakdown of nitrogen was studied in uniform fields.



# **The more complex the idea, the more revisions are needed to clarify it**

**At high pressures (760 torr) and typical electrode gap distances (1 mm), the electrical breakdown of nitrogen was studied in uniform fields.**



**This study examines the electrical breakdown of nitrogen in uniform fields. For these experiments, the electrode gap distances were typical (1 mm), while the pressures were relatively high (760 torr).**



## **Besides casting your ideas into clear sentences, you have to connect those ideas**

**Mount St. Helens erupted on May 18, 1980. A cloud of hot rock and gas surged northward from its collapsing slope. The cloud devastated more than 500 square kilometers of forests and lakes. The effects of Mount St. Helens were well documented with geophysical instruments. The origin of the eruption is not well understood. Volcanic explosions are driven by a rapid expansion of steam. Some scientists believe the steam comes from groundwater heated by the magma. Other scientists believe the steam comes from water originally dissolved in the magma. We need to understand the source of steam in volcanic eruptions. We need to determine how much water the magma contains.**

**Besides casting your ideas into clear sentences,  
you have to connect those ideas**



[USGS, 1980]

## **Besides casting your ideas into clear sentences, you have to connect those ideas**

z  
z  
z

**Mount St. Helens erupted on May 18, 1980. A cloud of hot rock and gas surged northward from its collapsing slope. The cloud devastated more than 500 square kilometers of forests and lakes. The effects of Mount St. Helens were well documented with geophysical instruments. The origin of the eruption is not well understood. Volcanic explosions are driven by a rapid expansion of steam. Some scientists believe the steam comes from groundwater heated by the magma. Other scientists believe the steam comes from water originally dissolved in the magma. We need to understand the source of steam in volcanic eruptions. We need to determine how much water the magma contains.**

**Having a wide variety of sentence openers allows for more kinds of transitions between sentences**



# Having a wide variety of sentence openers allows for more kinds of transitions between sentences



Topic of Sentence

Time or place of action

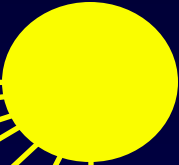
Sentence

← Manner of action

Subordinate action

Reason for action

## **Varying sentence openers enlivens the writing and leads to better connections**



**Mount St. Helens erupted on May 18, 1980. Its slope collapsing, the mountain emitted a cloud of hot rock and gas. In minutes, the cloud devastated more than 500 square kilometers of forests and lakes. Although the effects of the eruption were well documented, the origin is not well understood. Volcanic explosions are driven by a rapid expansion of steam. Recently, debate has arisen over the source for the steam. Is it groundwater heated by magma or water originally dissolved in the magma itself? To understand the source of steam in volcanic eruptions, we have to determine how much water the magma contains.**

# As a conclusion, references exist to help you with the many stylistic choices in scientific writing



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[Slides: Technical Writing](#)  
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These guidelines for engineering writing and scientific writing are designed to help students communicate their technical work. To that end, these guidelines contain advice, models, and [exercises](#) for common writing and speaking assignments in engineering and science.

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[Selecting the Format](#)  
[Crafting the Style](#)

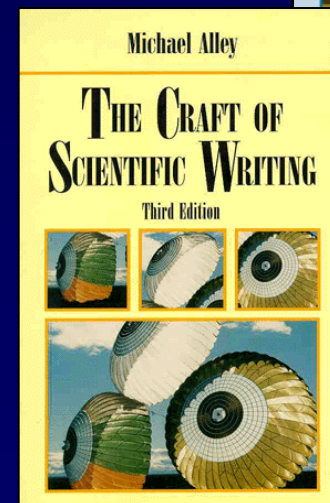
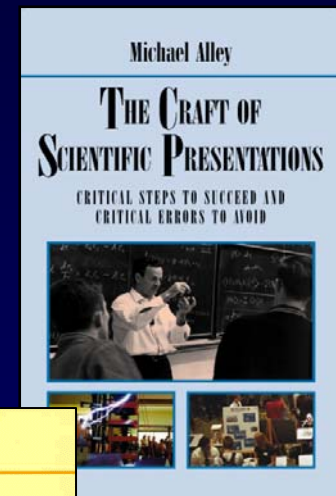
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