Structure in Scientific Writing

These slides, which are used in graduate and undergraduate engineering courses at Virginia Tech, come from Chapters 2 and 3 in *The Craft of Scientific Writing* (3rd ed., Springer-Verlag).
Structure: the Strategy of Style

If a man can group his ideas, then he is a writer.

Robert Louis Stevenson
The organization of a scientific document can be viewed as a beginning, middle, and ending.
<table>
<thead>
<tr>
<th>Section</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>orients readers to document</td>
</tr>
<tr>
<td>Summary</td>
<td>tells readers what happens in document</td>
</tr>
<tr>
<td>Introduction</td>
<td>prepares readers for the middle</td>
</tr>
</tbody>
</table>
A strong title orients readers to your area of work

Effects of Humidity on the Growth of Avalanches

Effects of Humidity on the Growth of Electron Avalanches in Electrical Gas Discharges
A strong title also separates your work from everyone else's work.

Studies on the Electrodeposition of Lead on Copper

Effects of Rhodamine-B on the Electrodeposition of Lead on Copper
Several names for summaries exist

- Summary
- Technical Abstract
- Informative Abstract
- Abstract
- Descriptive Abstract
- Executive Summary
Although several names exist for summaries, there are essentially two approaches

This paper describes a new inertial navigation system for mapping oil and gas wells. In this paper, we will compare the mapping accuracy and speed for this new system against the accuracy and speed for conventional systems.

This paper describes a new inertial navigation system that will increase the mapping accuracy of oil wells by a factor of ten. The new system uses three-axis navigation that protects sensors from high-spin rates. The system also processes its information by Kalman filtering (a statistical sampling technique) in an on-site computer. Test results show the three-dimensional location accuracy is within 0.1 meters for every 100 meters of well depth, an accuracy ten times greater than conventional systems.
A document's introduction prepares readers for the discussion.

- Topic?
- Importance?
- Background?
- Arrangement?
The introduction defines the scope and limitations of the work.

**Proposed Study on Effects of Alcohol on Life Expectancy**

- Three classes of drinkers: non-drinkers, moderate drinkers, heavy drinkers
- Men surveyed
- Ten-year study
- Other effects, such as exercise, not considered
- Women may not experience the same effects
- Medical histories not considered
This paper presents a design for a platinum catalytic igniter in hydrogen-air mixtures. This igniter has application in nuclear reactors. One danger at a nuclear reactor is a loss-of-coolant accident. Such an accident can produce large quantities of hydrogen gas when hot water and steam react with zirconium fuel rods. In a serious accident, the evolution of hydrogen may be so rapid that it produces an explosive hydrogen-air mixture in the reactor containment building. This mixture could breach the containment walls and allow radiation to escape.

Our method to eliminate this danger is to intentionally ignite the hydrogen-air mixture at concentrations below those for which any serious damage might result.
In the middle of a report, you present your work.
Common strategies exist for the middles of scientific reports

Chronological

Flow
Common strategies exist for the middles of scientific reports

Parallel Parts

Spatial
Section headings should be descriptive and parallel

<table>
<thead>
<tr>
<th>Non-Parallel</th>
<th>Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Descriptive</td>
<td>Descriptive</td>
</tr>
</tbody>
</table>

- Introduction
- Background
- Marx Generators
- Line Pulse
- Beam Generation
- Transporting Beam
- Pellets
- Results
- Conclusions

- Introduction
- Past Designs for Particle Beam Fusion
- New Design for Particle Beam Fusion
  - Charging Marx Generators
  - Forming Line Pulse
  - Generating Particle Beam
  - Transporting Particle Beam
  - Irradiating Deuterium-Tritium Pellets
- Results of New Design
- Conclusions and Recommendations
When you divide a section into subsections, all the pieces should be of the same pie

Calculations for Fan Performance
  Calculations of Volumetric Flow Rate
  Calculations of Fluid Power
  Calculations of Efficiency
### Performance of the Solar One Receiver

**Introduction**

**Steady State Efficiency**

**Average Efficiency**

**Start-Up Time**

**Operation Time**

**Operation During Cloud Transients**

**Panel Mechanical Supports**

**Tube Leaks**

**Conclusion**

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### Performance of the Solar One Receiver

**Introduction**

**Receiver’s Efficiency**

- Steady State Efficiency
- Average Efficiency

**Receiver’s Operation Cycle**

- Start-Up Time
- Operation Time
- Operation During Cloud Transients

**Receiver’s Mechanical Wear**

- Panel Mechanical Supports

**Tube Leaks**

**Conclusion**
In a strong ending, you analyze results and give a future perspective.

Conclusions
Analysis of Results

Future Perspective

Several options:
- Make recommendations
- Discuss future work
- Repeat limitations
For almost a hundred years, experts have been concerned with the increasing concentrations of gases such as carbon dioxide, methane, and nitrogen oxides in the earth's lower atmosphere. These gases are natural by-products of combustion. Figure A-1 illustrates the correlation between global temperature and carbon dioxide concentrations...
Appendix B
Project Stormfury

In 1961, the United States Weather Bureau and the Department of Defense (Navy) began a project to reduce the strength of hurricanes. The project, called Project Stormfury, uses cloud seeding, a process used to produce rainfall and reduce hail in thunderstorms. In Project Stormfury, silver iodide crystals, similar in structure to ice, are dispersed by airplanes in the upper reaches of cloud formations just outside the hurricane's eye where the winds are highest. Initial results showed that wind speeds decreased between 15–30% after seedings...
For secondary readers, use a glossary to define unfamiliar terms

Glossary

*burst point*: the exact point in space where an atomic bomb is detonated.

*clear visibility*: a viewing range of twenty miles.

*fallout*: the descent to the Earth's surface of radioactive particles from a cloud contaminated with the fission products of a nuclear explosion.

*hypocenter*: the point on the earth's surface directly below the burst point; also called ground zero.
Failing to cite the contribution of others can be a fatal flaw in your career.

James Watson surreptitiously looked at Rosalind Franklin’s work.

Watson did not give enough credit to Franklin.