Astrophysics made simple
Why Have A Course on Science Communications?

Whatever else you might do in your career, you will almost certainly be writing/presenting extensively!

A sampling of what I wrote in the past year…

-- 3 journal articles…
-- 4 research proposals…
-- A huge number of recommendation letters!…
-- About 15 nominations for awards and fellowships
-- About 20 referee reports on manuscripts and proposals…
-- Many seminar talks, lecture notes, etc., etc.

One thing that characterized all of this writing is that it had to be aimed at an audience unfamiliar with my research or the research of the individual(s) I was describing.
Why is Persuasive Communication Important in Science?

Communicating your scientific results is not just about having good data or doing a significant calculation (although these are critical also!): you must also present your results and support your conclusions both logically and clearly!

The more inexpert your audience, the more important it will be for you to write/present your results clearly and logically!

Persuasive scientific writing (as we’ll define it in this course) is:

-- logically structured and supported with evidence (so your conclusions are defensible to a highly critical audience)

-- clearly and succinctly expressed (so the reader can understand your arguments and ideas without getting lost)
How to Approach Writing Projects in Phys 598 PEN

In this course, we’ll discuss and practice establishing logical structure in, and improving clarity of, your scientific writing/presentations, *particularly for non-expert audiences*!

How to approach a writing/presentation project?

1. Identify your audience (e.g., expert, general, etc) – this will govern the level of the presentation.

2. Write down the key ideas you want to convey – this is governed by the length of the paper or presentation, and will dictate the background information you’ll provide and the evidence you’ll present.

3. **Outline** the logical argument you’ll use to “prove” this idea – roughly speaking, each step in your logical argument is a paragraph.

4. Identify the supporting pieces of evidence you’ll use to justify your arguments, e.g., your own results, literature references, etc.

5. Convey your ideas (sentences) as **simply** as possible, in a logical order.
Paragraph Structure

Every paragraph should contain roughly one idea + supporting evidence for that idea, if possible (see http://people.physics.illinois.edu/Celia/Lectures/Paragraphs.pdf)

The first sentence in each paragraph is usually the main idea, i.e., the “topic sentence”, while the body of the paragraph supports that idea, then transitions to the next paragraph.

paragraph 1
Idea 1, supporting examples/references, logical transition to next idea

paragraph 2
Idea 2, supporting examples/references, logical transition to next idea

e tc., etc.
To create a logical structure in your scientific writing and presentations, create an outline!!

Example of basic (Level 1) structure of scientific outline:

I. Introduction (Get the reader's/viewers attention; states key idea(s) or thesis; provides essential background)

II. Procedures (Provides background on key experimental/theoretical methods)

III. Results (Presents key results that support ideas discussed in Introduction)

IV. Discussion (Interprets results; Discusses results in the context of prevailing models)

V. Summary and Conclusions (Reemphasizes key results and how they support thesis; Discusses new directions)
Building a Logical Structure: Outlining

Example of a more detailed (Level 2) structure of scientific outline:

I. Introduction
   A. Attention-grabbing, “big picture” statement of issue
   B. Key previous results leading to state of the field
   C. Unaddressed problems
   D. Preview of key points of talk/paper

II. Procedures
   A. Experimental methods
   B. Theoretical methods
   C. Data processing
   D. Error analysis

III. Results
   A. Key results 1
   B. Key results 2
   C. Key results 3

Provides more details of internal organization of each section
IV. Discussion
   A. Interpretation of results
   B. Comparison with key models/previous results
   C. Possible sources of errors

V. Summary and Conclusions
   A. Reemphasis of key results
   B. Summary of key conclusions
   C. Possible future directions
   D. Exciting closing statement

Provides more details of internal organization of each section
Building a Logical Structure: Outlining

Example of an even more detailed (Level 3) structure of scientific outline:

I. Introduction
   A. Attention-grabbing, “big picture” statement of issue
      i. Interesting diagram to show
      ii. Interesting quote to give
   B. Key previous results leading to state of the field
      i. Specific papers that will be referenced
      ii. Previous ideas that will be emphasized
   C. Unaddressed problems
   D. Preview of key points of talk/paper

II. Procedures
   A. Experimental methods
      i. Experimental diagram to show
      ii. Procedural flow chart #1
   B. Theoretical methods
   C. Data processing
      i. Flow chart describing data analysis
   D. Error analysis

Provides specific details, figures, quotes, references, sentences, etc. to support section
Sentence Outlines

A more detailed outline to consider using is the “Sentence Outline,” which uses complete sentences to express key ideas and the logical progression of your paper/presentation.

Basic rules of the sentence outline (e.g., see http://www.physics.ohio-state.edu/~kagan/phy596/P596_SentenceOutlines.html for examples):

1. Use complete sentences to convey the main idea of a paragraph, avoiding extraneous detail.
2. Each sentence in the outline becomes the topic sentence of a separate paragraph.
3. Sentences should be as specific as possible (i.e., convey one idea).
4. The sentences should be organized to construct a clear logical argument supporting your conclusion.
Building a Logical Structure: Outlining

Make a habit of creating an outline for all your scientific papers and presentations!

Benefits of outlining:

(1). Your papers and presentations will be logically organized from the beginning:

Everything should be made as simple as possible, but not simpler.

(2). Outlining forces you to identify the key points you want to make, and helps you avoid including extraneous information that will distract the reader from the logical flow of your argument: *always write simply!*

(3). Outlines allow you to break up large projects into more manageable chunks that you can tackle (e.g., your thesis, a big review article, etc.)

(4). Outlines allow you to easily expand or contract material to different length presentations or papers.