

How to learn to write?

It's hard! Practice makes perfect, or at least better

Mostly by emulation (copying) approaches that others take.
Sometimes courses like this one.

- First step: have a clear focus.
 - Focus, focus, focus!
- Second step: recognize that writing is mostly an art, not an exact science.
- Third step: acknowledge that some rules and guidelines apply, and that there is a recommended process.

Practice as a writer and as an editor!

Problems with Scientific Writing

Most frequent problems:

- dense
- boring
- obscure
- arrogant
- difficult to read
- often grammatically sloppy
- **logic is unclear (maybe even to the author!)**

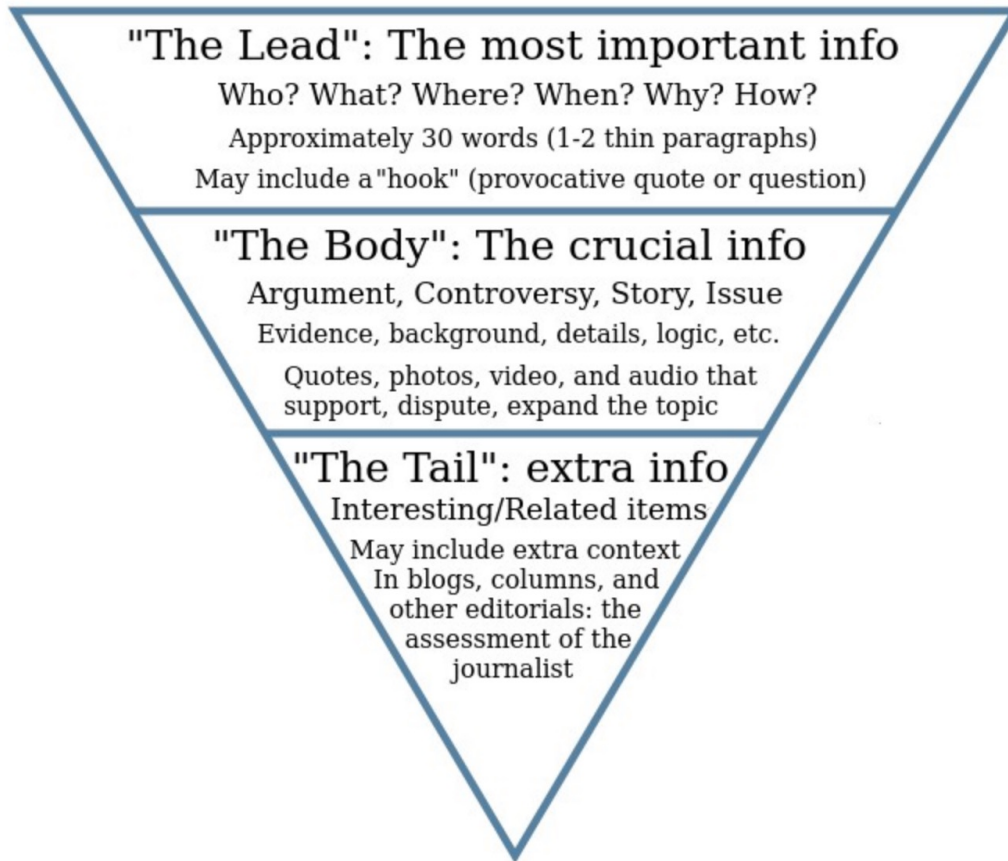
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Goal: communicate by describing as simply as possible your methods and results

General rules

- There are no rules. I will teach you some things that others will disagree with.
 - Example: avoid almost all acronyms! (My rule, your advisor may differ; that's ok)
 - Exceptions: Telescopes/instruments, ISM, AGN, FRB
- **Logical flow is most important**
 - We will also cover grammar, but focus is on logic
- Approach: outlining
 - This approach differs from my own methods
 - I often “outline” in plot form. Plots tell the story, text explains the plots
- **EDITING: critical to good writing**
 - When first writing, “throw up on the page”
 - Don't try to become a good writer, try to become a good editor.
- Tell a story of discovery (but not in chronological order)

Logic: funnel flow structure



- Inverse pyramid: start big and get smaller
 - This applies both to the structure of a section and to each paragraph in the structure
- DO NOT: build up to a surprising conclusion!
 - This is not Avengers; conclusions come first

Beginning Considerations

Need something to write about!

- Topic and details
- Expression of content in a single sentence
 - “thesis sentence”
 - We will come back to this sentence later, for proposals
 - “elevator speech”
- Specific audience and specific purpose
- Format, genre/style, and length (“instructions to authors”)
- Think about the who / what / when / where / why
- Take the reader’s perspective

Beginning Considerations

- Need to know your topic. In fact, **own it**.
 - This is not the goal of this class. I cannot help you generate your science, but I can help you communicate it.
 - It **is** the goal of your PhD.
- Collect and study your references and new material
- Research Resources:
 - ads: Astronomy and Astrophysics research literature
 - Look at highly cited (recent) papers, review papers if you are unfamiliar with an area
 - Daily astro-ph in your own field
 - Wikipedia and google searches

Good Advice

- Begin from the end, not the beginning.
 - Tell the story in plots, then explain the plots
- It is important to know:
 - your needs as an author
 - what are you trying to say?
 - any requirements for the end-product
 - the capabilities and needs of the end-user.
- Ask yourself
 - what you would like to see in your paper
 - who will be reading it
 - what format is required
- Then follow the steps of an academic writing framework.

Generic outline of a research paper

- Title: orients reader
- Abstract: tells reader what happens
- Introduction: prepares reader with context/importance
- Observations/methods:
- Results: dig into details
- Analysis: apply results
- Discussion:
 - Connect analysis back to introduction; why are your results important?
- Conclusion: Summarize your results
 - What are the most important results
 - Repeat important limitations and caveats

Generic outline of a research paper

- Title
 - Exact
 - Clear and complete, but succinct
 - Strong and noticeable or boring
- Abstract
 - Optional: one sentence intro
 - Key information expressed concisely
 - Enticing and inspirational
 - Descriptive

The title and abstract are the two elements
that will attract readers to your work!

Generic outline of a research paper

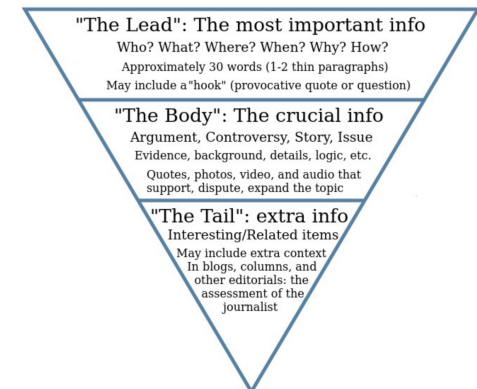
Introduction: context for your research

- Motivation and importance of problem (the “why?”)
- Background, history, context, previous literature (the theory)
- Current state and unknown/s (the questions)
- What and how of current contribution (the hypothesis)
- Approach, scope and limitations (the objective)
- Layout of presentation (the roadmap)
- Note: does not actually begin the argument

The introduction prepares the reader and generally follows a cohesive “funnel flow” or “inverse pyramid” structure.

Generic outline of a research paper

- Middle
 - Observations, simulation setup, equations
 - Data reduction or equation development
 - Analysis techniques and figures/narrative, in digestible portions
 - All of above in enough detail for a trained scientist to repeat work
 - Findings (results) and interpretation
 - Discussion of and implications of results; compare to others'
- End
 - Summary, conclusions, future work (nothing new)
 - Acknowledgments
 - References



Second assignment: Introductions

- Reverse outline the introduction from the good paper
 - Sentence by sentence
- Start your own outline
 - If already have an outline, reverse outline what you already have