Scientific Writing 6951

Wednesdays 10-12 Room 0.008

http://www.astro.uni-bonn.de/~izzard/writing.html

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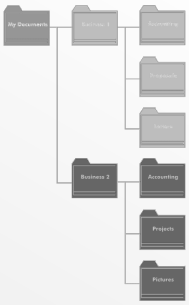
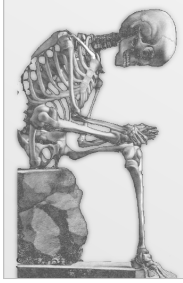
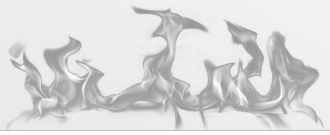
Previously on *Scientific Writing*

- Raw materials
- Literature review
- Brainstorming
- Organise your files
- Writer's block
- "Skeleton" article







Exercise

- You each chose a homework subject
- In groups of three (each with different subjects!)
- You have to write a paper for **1st year undergraduates** on your subject
- 15 minutes of brainstorming for each of you : remember to think outside the box!
- **What ideas will you put into the paper?**

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Today

- The body of a (traditional) article
  Intro : Method : Results : Discussion : Conclusions
- **What** to put in each:
  - Section
  - Subsection
  - Paragraph
  - Sentence
- From **paragraphs** to **sentences**:

  preparing to get on with writing.

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Logical progression

- Your article should read in a **logical way**
- **Move** from one subject to the next **smoothly**
- Try to **link** paragraphs, sentences etc.
- Practice this! **Read** and **write** yourself.
- Go from **general** to **specific**.

Logical progression is the key to smooth reading and good understanding.

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Introduction

- Define the problem/topic.
- Tell the reader **why** they should be interested, **why** is it important?
- **Why** was the research undertaken?
- Scientific background **required** to understand/judge the paper
- Relate to **previous work**: literature review (brief as possible, complete as it must be)

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Introduction

- State (new) ***hypothesis***
- **Objectives** of this work
- Define terms, abbreviations, **acronyms**
- Arrange the article ***for the reader***:
  "we present *x* in section 2, *y* in section 3..."
- Usually: **no** figures or tables
- Two pages is typical
- Usually written in the **present tense**

Method

- Explain in **logical** - *which is often* ***chronological*** - order
- Must be enough information for another researcher to **repeat the process**
- **Cite** when you can, keep it **short**.
- This is the place for ***important*** technical information
- Use **graphics** (class 6!) and tables to clarify
- **Equations** are fine (class 6! next week!)

Method

- No **unnecessary** details
- State **assumptions** you make
- Be precise: ***never ambiguous***! Always give units, define acronyms...
- ... but precise does not mean too much detail. It is a **balance**. (practice!)
- Usually written in the **present tense**.

Results

- Describe what the results ***are***. (present tense!)
- Clearly state what ***you*** find: Keep it simple!
- If you find many similar things
  present one in detail
  not an endless (boring) list !
  (this is what figures, tables and appendices are for)

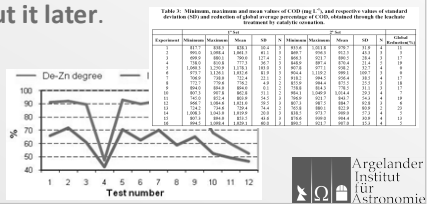
- **Negative results** should be reported if they are important but as with positive results avoid unnecessary details

Results

- Do not include results which are **not directly related** to the aim of the paper
- **Figures** and **tables** (next week!)
  again, only what you **need**
- First draft: include what you might need, you can (should!) always **cut it later**.

$$[\mathrm{Fe/H}] = -1.5 \pm 0.2$$

$$H_0 = 42\,\mathrm{km\,s^{-1}}$$



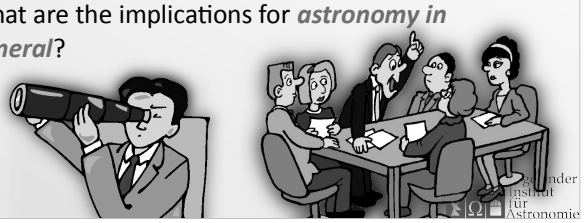
Discussion

- In this section you explain what the results mean. ***What is their implication?***
- This is the **most difficult** -- and perhaps most important -- part of the paper.
- Demonstrates the ***significance*** of your work and ***your ability*** to interpret it.
- If the reader ends up saying ***"so what?"***
  you have **failed**.

- **Do not repeat** what has already been said in previous sections

Discussion

- Relate the **results** to the **thesis** of the paper
- Show how the results **agree/disagree** with previous work.
- What are the **implications** of the work to the immediate field?
- What are the implications for ***astronomy in general***?



Conclusions

- In the introduction you had **objectives**. In the same order, write the conclusion to these **objectives**.
- If possible, have one big, important conclusion. Make this ***VERY*** clear.
- Avoid detail and repetition:
  remember non-linear reading!
- Further work is necessary? Maybe...
  Future *perspective*.
- Results in the **past** or **present** tense.

Acknowledgements, Appendices, Glossaries

- **Acknowledge**
  - Funding agencies
  - Colleagues who helped (should they be authors?)
  - Referee (if they were useful!)
  - Institutes you visited

- Avoid **humourous anecdotes**:
  Humourless **editors** tend to remove them.

Acknowledgements, Appendices, Glossaries

- **Appendices**
  - Follow the main article, referenced in it
  - Extra data, useful to a subset of the audience
  - Long derivations (lots of equations, figures)
  - Still part of the article!
- **Glossary**
  Explains the meaning of words
  Useful in dissertation, not so much in journal articles.

Order of writing

Typically:

- ***Method*** -- the stuff you wrote, should be relatively easy
- ***Results*** -- also your stuff
- List objectives (end of the ***introduction***)
- ***Results*** -- compare to objectives
- ***Introduction*** and ***Discussion*** -- write these together to make sure the objectives in the introduction are addressed in the discussion

Sections and Subsections

- **Sections, subsections, sub-subsections...** sometimes the writer gets to choose. The subsections should all be of roughly the same importance.
- Use subsections when you have a good ***logical*** reason to do so.
- NOT a replacement for **good transitions** between paragraphs!
- Consider other formatting:
  bullet list, **enumerated** list, etc.

i.	a)	1.
ii.	b)	2.
iii.	c)	3.
iv.	d)	4.
v.	e)	5.
vi.	f)	6.

Sections and Subsections

Section 2: Method

The following section describes our experimental setup. Do not forget your introductory sentence(s)!

Section 2.1: Ion Source

The ion source is a ray gun from Star Trek. Blah blah blah

Section 2.2: Ion Target

We use a block of wood as the target for our ion beam. Blah blah blah

These are titles like any other titles!

You know all about titles :)

Sections to Paragraphs

- What is a **paragraph**?
- One idea per paragraph!

  Paragraph = unit of information
- Explore the idea/theme in the paragraph
- Again: **Logical flow:**

  topic sentence, then **expand**
- Not too short: not too long
- **Coherence** is critical!

Sentences

- **Unit** of **communication**
- Maintain the logical connection between sentences
- **Link** sentences by **subject**, **object**, **action** etc.
- Not too short
- Not too long
- Not **repetitive** in form
- **Mix up** passive and active voice

Sentence transition

- Sequence: Two things happened last night. **First**, we drank beer. **Second**, we fell over.
- Compare and contrast:

  Even though I was hungover I followed Prof. Izzard's lecture
- Give examples: German beer is bland. **For example,** the many varieties of Koelsch taste ***identical***.
- Timing: **Since 1516** German beer laws have prohibited the brewing of tasty ale.
- Emphasis: **Especially classy** is the Belgian gueuze.
- Conclusions: **To summarize,** German beer is not as good as Germans like to think.

See *Eloquent Science* p71

Parallelism

- Consistency in sentences e.g. with *and*, *or*, *but*, *when* ...

  The data points are independent but they **are lying** on top of one another.

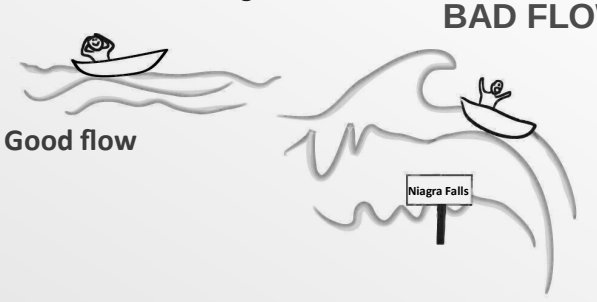
  The data points are independent but they lie on top of one another.

- **The** good, **the** bad and **the** ugly
- **The** good, bad and ugly
- **The** good, the bad and ugly
- Good, bad and ugly

Exercise

- Multiple choice: **the best sentences**
- Write **flowing** sentences

BAD FLOW



Good flow