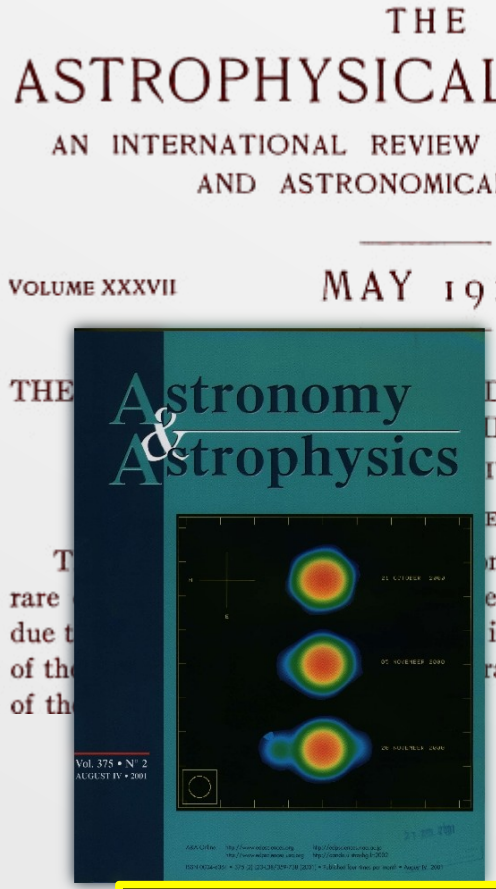
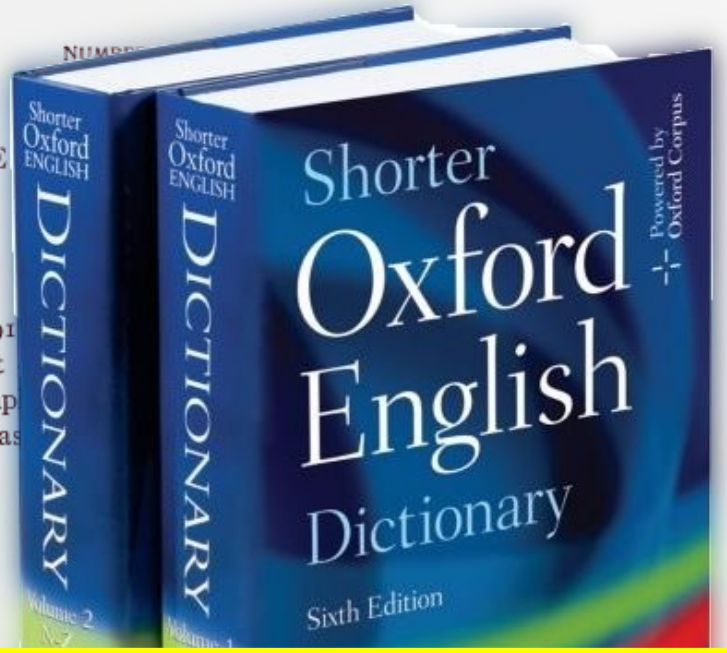
Scientific Writing 6951





Wednesdays 10-12 Room

0.008

http://www.astro.uni-

bonn.de/~izzard/writing.html

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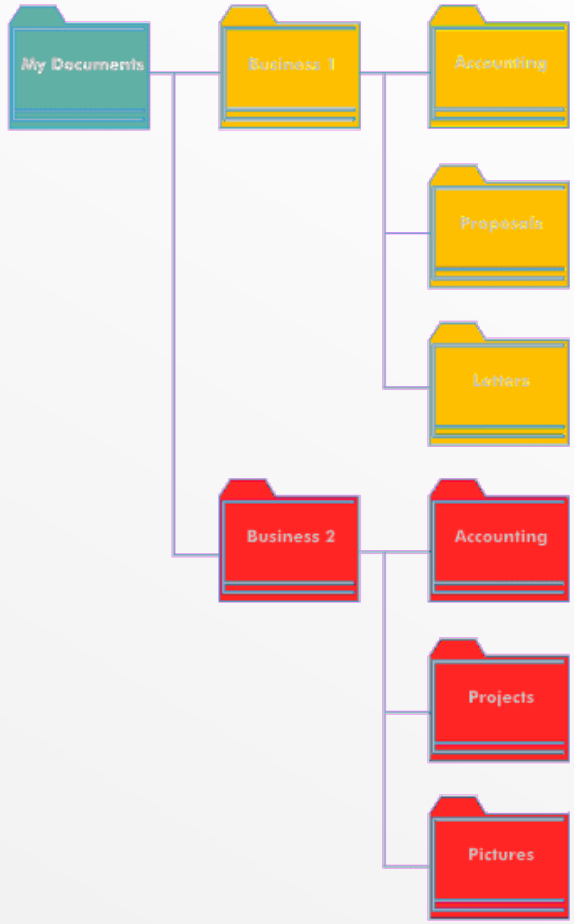
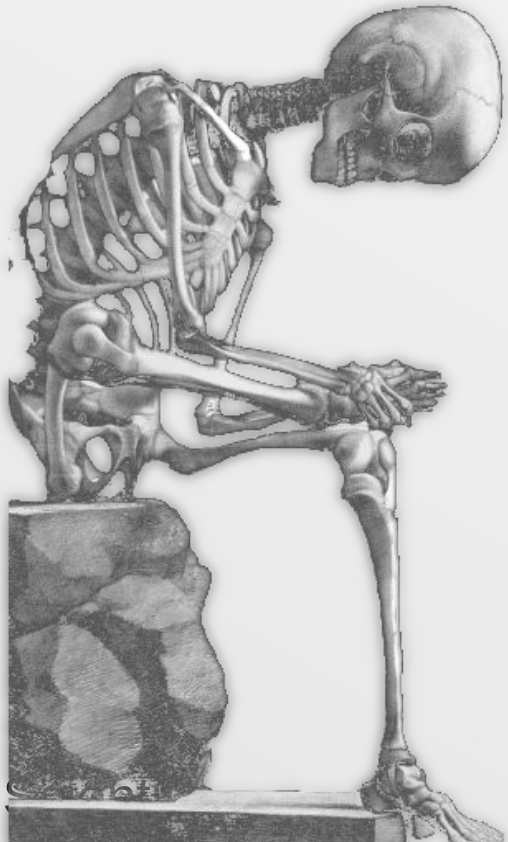
Previously on *Scientific Writing*

- 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?**

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.

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.

Introduction

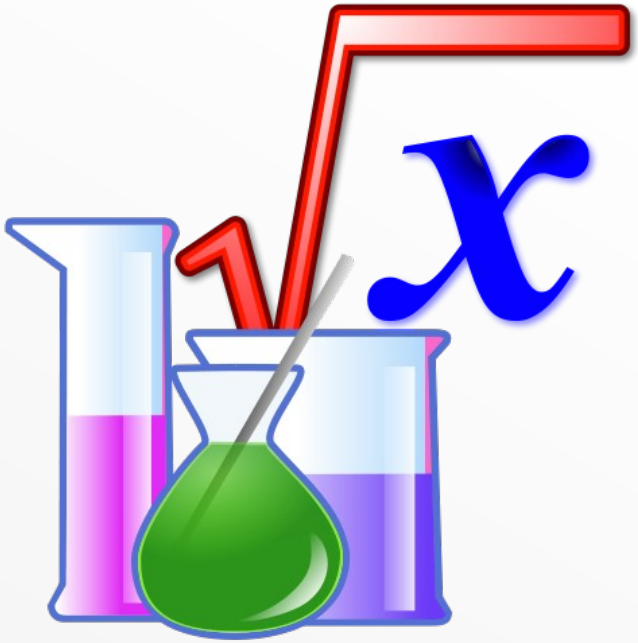
- Define the problem/topic.
- Tell the reader **why** they should be interested,
  why is it important?
- **Why** was the research undertaken?
- Scientific background **required** to understand/judge the paper
- Relate to **previous work**: literature review (brief as possible, complete as it must be)

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!)

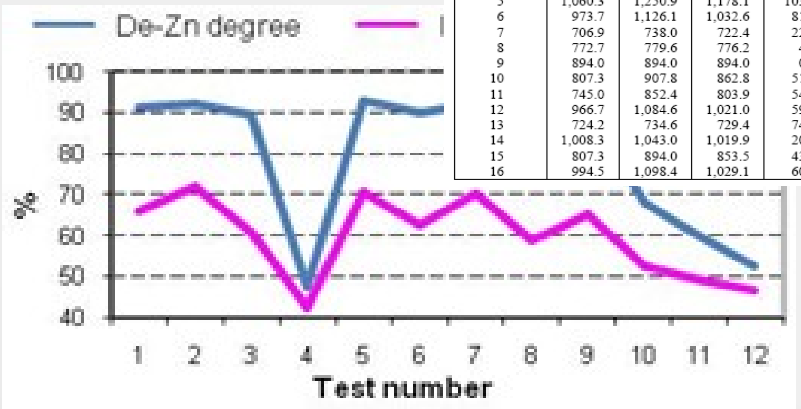
  again, only what you **need**
- First draft: include what you might need, you can (should!) always **cut it later**.

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

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

Table 3: Minimum, maximum and mean values of COD (mg L^{-1}), and respective values of standard deviation (SD) and reduction of global average percentage of COD, obtained through the leachate treatment by catalytic ozonation.

	1° Set					2° Set					
Experiment	Minimum	Maximum	Mean	SD	N	Minimum	Maximum	Mean	SD	N	Global Reduction(%)
1	817.7	838.5	828.1	10.4	3	935.6	1,011.8	979.7	31.9	4	11
2	991.0	1,098.4	1,061.5	61.1	3	869.7	956.3	912.5	43.3	3	3
3	699.9	880.1	790.0	127.4	2	866.3	921.7	890.5	28.4	3	17
4	738.0	810.8	777.3	36.7	3	848.9	897.4	870.4	21.4	5	19
5	1,060.3	1,250.9	1,178.1	103.0	3	907.8	977.1	938.2	32.7	4	0
6	973.7	1,126.1	1,032.6	81.9	3	904.4	1,119.2	999.1	109.7	3	0
7	706.9	738.0	722.4	22.1	2	918.2	994.5	956.4	38.5	4	17
8	772.7	779.6	776.2	4.9	2	855.9	904.4	875.5	25.5	3	18
9	894.0	894.0	894.0	0.1	2	758.8	814.3	778.5	31.1	3	17
10	807.3	907.8	862.8	51.1	2	984.1	1,049.9	1,014.4	29.3	4	7
11	745.0	852.4	803.9	54.5	3	796.9	921.7	843.7	54.3	4	19
12	966.7	1,084.6	1,021.0	59.5	3	807.3	987.5	884.7	92.8	3	6
13	724.2	734.6	729.4	74.4	2	765.8	880.1	822.9	80.9	2	23
14	1,008.3	1,043.0	1,019.9	20.0	3	838.5	973.7	909.0	57.3	4	5
15	807.3	894.0	853.5	43.6	3	876.6	939.0	904.4	30.9	4	13
16	994.5	1,098.4	1,029.1	60.0	3	890.5	921.7	907.0	15.3	4	5



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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.

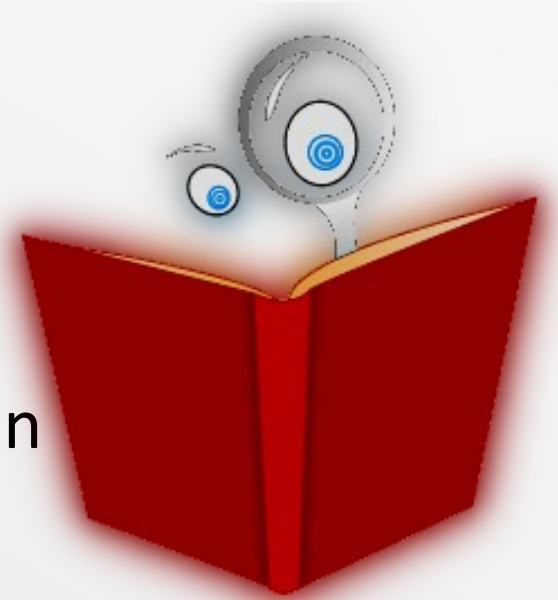
Acknowledgements, Appendices, Glossaries

- **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

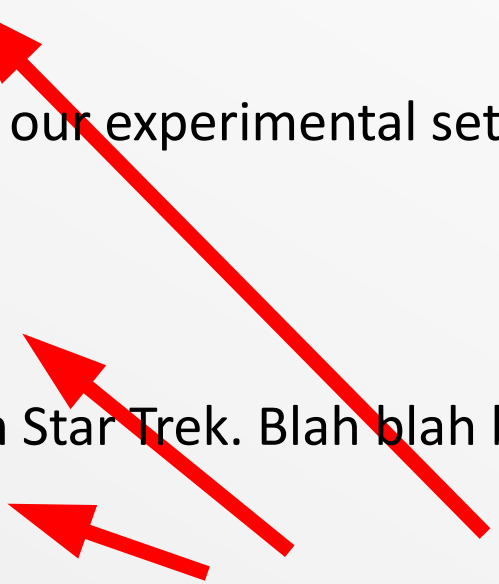
The following section describes our experimental setup. Do not forget your introductory sentence(s)!

Section 2.1: Ion Source

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

Section 2.2: Ion Target

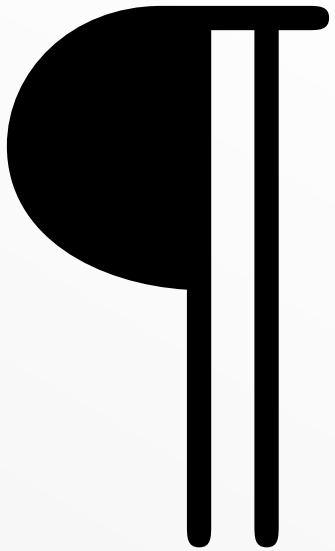
We use a block of wood as the target for our ion beam. Blah blah blah



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