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Introduction to Scientific Writing

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Trends in Bioinformatics Seminar

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Agenda

- General
- Paper Sections
- Further Recommendations
- Writing Style

General – Aims of Research

- Extend knowledge of mankind
  - Identify a **problem** that has not been solved yet
  - Formulate the problem or a question
  - Solve the problem/answer the question
- Have an overview of **existing approaches**, literature, and related issues
- **Organize your arguments** and results to be
  - Short,
  - Profound, and
  - Expressive

General – Types of Scientific Publications

- Methodical paper: New algorithms, systems, etc.

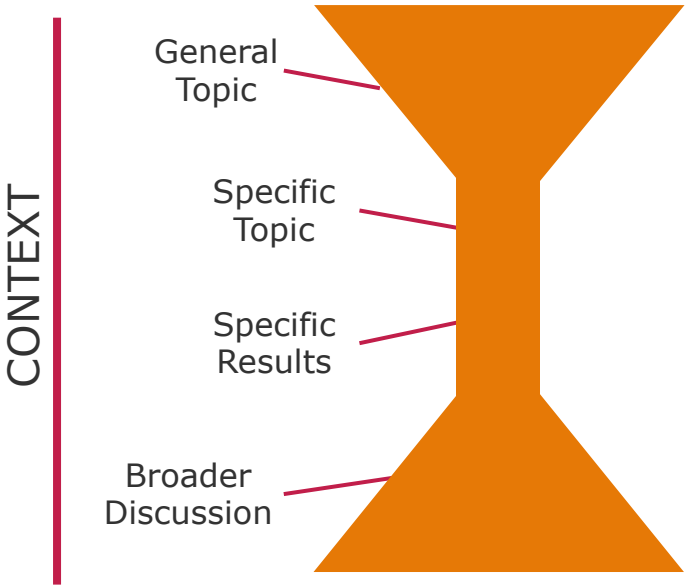
most typical scientific publication

- Review / survey paper: Status quo / current status of a research area
- Concepts paper: New ideas or theories without concrete realization
- Evaluation paper: Quantitative comparison of different approaches
- Technical Report: Notification of current status of an approach within organization, usually no review

General – Writing Procedure

- Every paper **tells a story** – **know your story!**
  - What: What you want to find, the problem being solved
  - Why: Purpose and rationale
  - How: Your approach
- **Write for the reader, not for yourself!**
- Plan your document structure: Create an outline, discuss with others
- Write top-down: broad themes/ideas first, then go into detail

Paper Structure – Hourglass



- Title
- Abstract
- Introduction
- (Background)
- Related Work
- Main Part
- Conclusion
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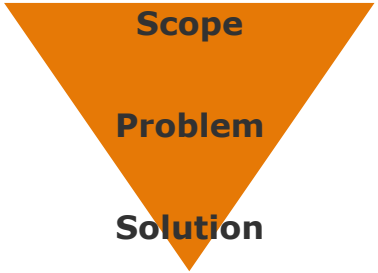
See also: IMRAD structure (https://en.wikipedia.org/wiki/IMRAD)

Paper Structure– Abstract

- Usually not more than 140 words
- Reflects the main story of the research paper
- **Calls attention** – make the reader curious about the content!
- Short and concise sentences
- Always follows a **funnel** structure
  - Scope – What is the general context?
  - Problem – What is the specific problem?
  - Significance – Why is it a problem?
  - Solution – How do you solve it?
  - Evaluation – Does your solution fulfill expectations (very short)?



Paper Structure– Introduction

- Structure of abstract also applicable here, but in more detail
- First paragraph important: Reader decides here to continue reading!
- Particular tasks:
  - Introduce the topic and define the terminology
  - Indicate the focus of the paper and research objectives
  - Last paragraph outlines the structure of the paper
- Do not present your results here

What is the problem you specifically consider?

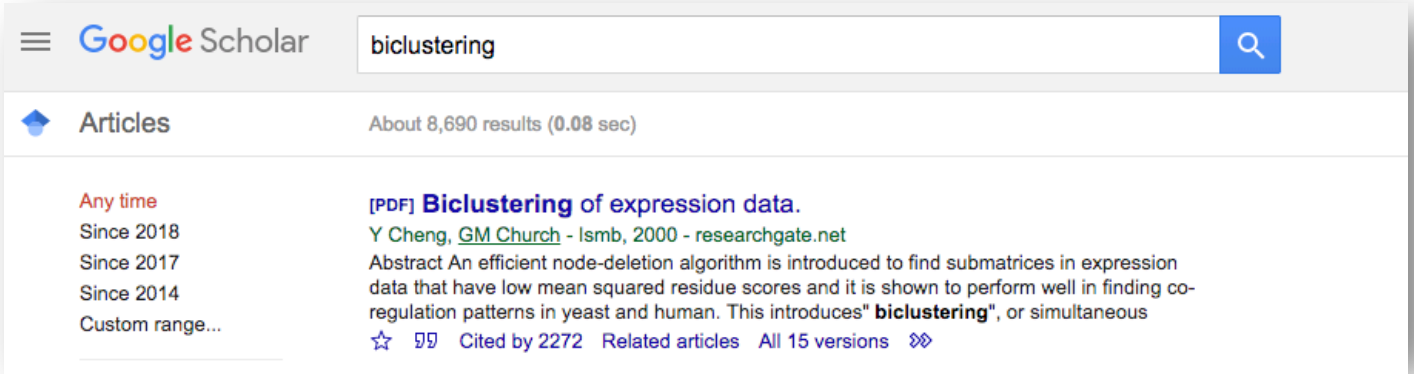
Paper Structure– Related Work

- Purposes:
  - Help understanding the field and the problem
  - Show that you are aware of what is outside and appreciate the work of your colleagues
  - Compare and differentiate your work with the state of the art
- Content:
  - Strategies of the different approaches, strengths/weaknesses
  - How do we address potential shortcomings? (Contribution!)
- Useful instrument: Comparison table with your important criteria

	Approach A	Approach B	Our Approach
Criteria 1	x	x	x
Criteria 2	x	-	x
Criteria 3	x	x	x
Criteria 4	-	-	x

Related Work – Hints for Literature Review

- Backward/forward search for publications in online archives
  - IEEE: http://www.computer.org
  - ACM: http://www.acm.org
  - Google Scholar: http://scholar.google.com
  - Citeseer: http://citeseer.ist.psu.edu/
  - Uni Potsdam Library: http://info.ub.uni-potsdam.de/



Paper Structure– Main Part

- Conceptual part – Particular algorithm
- Implementation part – Architectural aspects of your prototype

Can also go in one chapter

- Results – What experiments did we run and what did we observe?
- Evaluation – What are the reasons for our observations?
- Discussion – What do these findings mean for our approach?

Remember your Chemistry protocols at school?

Paper Structure–Conclusion

- **NOT a summary**: Sum up your findings, not what you have done
- Answer research questions/objectives
- State the importance of discovery and future implications
- Strong statements should be made (avoid "it may be concluded…")

Further Recommendations – Figures

- Good figures can make a paper come alive
- Good figures communicate ideas or patterns in the data much better than big tables of numbers
- Choose reasonable captions
- Be aware of printing resolutions (300 dpi for colors, 600 dpi for b/w)
- Prefer shadings over colors – documents are usually printed in b/w mode

Be aware of color blindness

Further Recommendations – Tables

- Captions should not be too long, but also not *"architecture of …"*
- Same with figures: Choose reasonable captions
- Explain content in more detail in the text
- If something is not worth explaining it in text → do not put it in the table

Further Recommendations – Footnotes

- NOT for parenthetical comments – important things must be in the text
- Footnotes should be used for things the typical reader can genuinely skip
- Websites etc. also do not belong into footnotes, list them as reference

→ Footnotes stop readers, so better try to avoid

Further Recommendations – Citing

- Direct speech
  - *"With method … we achieve …"*
  - *X claims he "… has developed a methodology …"*
- Indirect speech – rather name system instead of authors
  - *X has developed a method …*
- Reference is not a subject of sentence – list it at the end of sentence
  - X has developed a method … [1].

Further Recommendations – Writing Style

- Less is more!
  - Reading pages of dense text is **no fun**
  - Do not overload with 40 graphs – provide the key facts and points
- Get a reader's point of view
  - No one can read your mind – provide enough context to understand what you write
  - Put the paper aside a couple of days, then read again
  - Starting 3 days before deadline is a non-starter

Further Recommendations – Writing Style

- Keep sentences short and precise (German problem…)
- Use **active** and **present** tense – do not switch tenses
- First sentence of a paragraph = lead sentence!
- Do not use abbreviations in headlines
- Avoid (self) assessments - *groundbreaking*, *good*,…
- Avoid vague statements - *possibly/probably*, *could/would/should*,…

Further Recommendations – Writing Style

- Be aware of the difference between ***such as*** and ***like***
  - *like* applies for closed bodies, i.e. you list all existing examples
  - *such as* applies for open d., i.e. there still exist other examples

→ *"Ice cream like vanilla"* vs. *"Ice cream, such as vanilla"*

- Check **correct reference** of your verbs if you have multiple objects

→ *"This results in incomplete patient records which eventually …"*

- Check your formulations for **correct meaningfulness** and reference

→ *"a method called HMW question"* vs. *"a method called formulation of HMW question"*

- Use **uniform phrasing** in listings

→ *"I like eating and to run"* vs. *"I like eating and running"*

Further Recommendations – Writing Style

- Do not describe circumstances - *"after eight hours we realized …"*
- That and which: If you can put a comma before it, use which
- Choose the way of your parenthesis according to importance
  - Important: Comma
  - Good to know: Hyphen
  - Actually not important at all: Braces (avoid these! ;)

Further Recommendations – Writing Style

- Absolute statements: Always relate to units
- Consistency throughout the text - spelling, formatting, etc.
- Think about what to highlight: no exclamation marks, use italic
- Do not continuously refer to earlier or later pages
- Add paragraphs between section headline and first subsection

And Finally…
Before Submitting Any Paper

- Are headlines uniformly formatted, e.g. capitalized?
- Are proper tenses and voices used?
- Are all equations mathematically correct and explained in the text?
- Are all abbreviations explained/introduced?
- Are all figures/tables relevant and of good quality?
- Are all figures, tables, and equations listed and mentioned in the text?
- Are all references relevant, up to date and accessible?
- Are the references structured in a uniform format?

Useful Links and Books

- Ad Lagendijk: Survival Guide for Scientists: Writing - Presentation – Email
- Academic Phrasebank: http://www.phrasebank.manchester.ac.uk/
- The Purdue Online Writing Lab - http://owl.english.purdue.edu/
- http://www.cs.columbia.edu/~hgs/etc/writing-style.html
- ftp://fast.cs.utah.edu/pub/writing-papers.ps
- http://www.itc.nl/library/Papers/hengl_rules.pdf
- http://www-net.cs.umass.edu/kurose/talks/top_10_tips_for_writing_a_paper.ppt

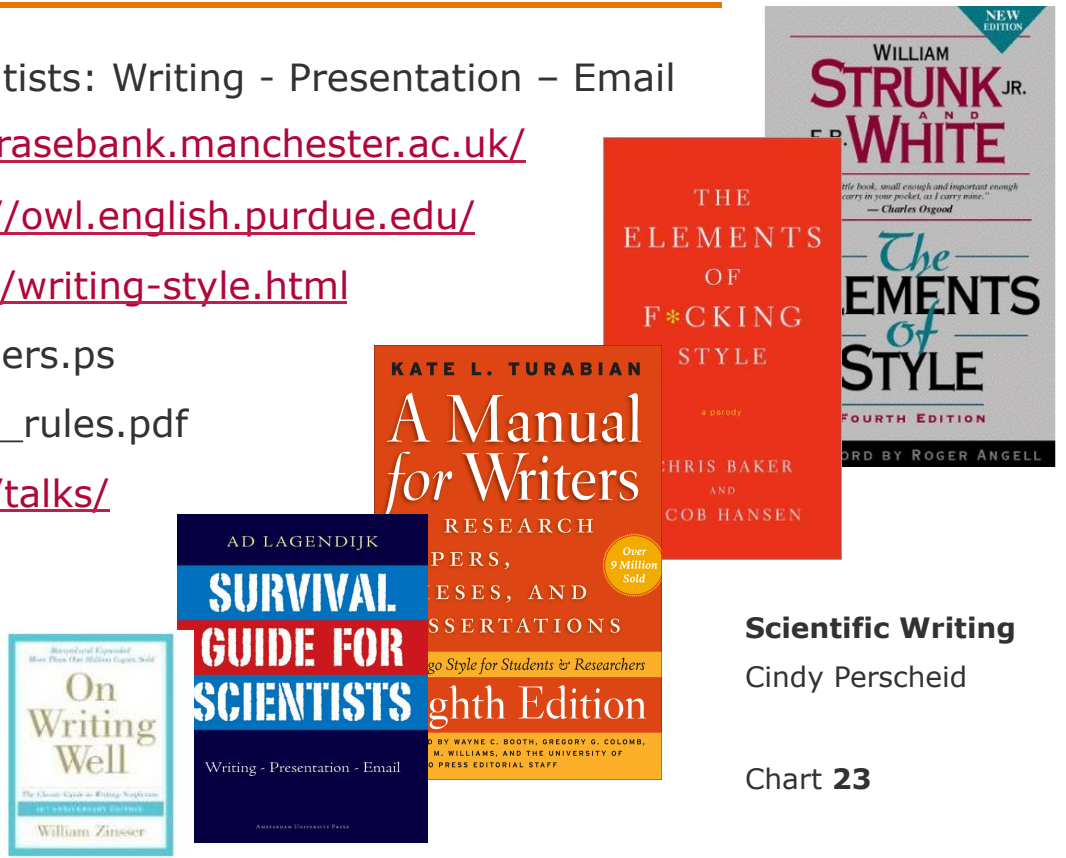


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Chart **23**