### Scientific Writing

**the biology perspective**

- The writing process
- Getting prepared
- From data to paper
- Getting to an end

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IST Austria – 15. March 2012

### The writing process

- don’t give a history of the process of your work, but clearly present your findings and discuss them in context with other peoples work and a broader perspective
- try to write „an interesting read“ it has to give information, but it shouldn’t be a boring list of facts
- writing has phases of sitting alone on your computer, but is also an interactive process that requires feedback from others
- start writing early and make additional experiments if needed (for paper or potential revisions)

### Writing Style

- aim for clarity, lack of ambiguity, precision
- don’t present unnecessary results or add extensive comments irrelevant to the main topic of the study
- the reader should be able to perform the same experiments after having read your text
  - give details on machines, chemicals, procedures
- don’t assume the reader knows what you know

### Before you start writing...

- agree with all co-authors on each persons role in manuscript preparation
  - lead in writing
  - figure preparation …
- order of authors & corresponding author
  - rules differ depending on the field
- communicate & keep others updated
- agree on deadlines
- use platforms if working on the same file
Before you start writing...

find a concept

- have all your data analysed statistically
- go back to your original research question you wanted to ask with your experiment (a proposal is helpful)
- could you confirm / reject your hypothesis?
  if not? more data needed? which ones? -> create them
do you need more information? -> read related work

Before you start writing...

select the journal you want to publish in
who will be my readership?
check the guidelines carefully:
how many words allowed for different manuscript sections
order of sections? Results & Discussion?
how many display items?
colour figures allowed?
Supplementary Material?
based on your figures and the order of the sections:
create a draft – skeleton of your text
note the number of words you are allowed to spend on each section

Before you start writing...

which data are needed, which give non-essential side information?
create figures (NO final versions!) of the most important findings
line them up into a „cartoon“ / picture story
this will be the of your paper!

Order of writing

1 Figures
2 Material & Methods and Results section
3 Discussion and Introduction
4 Abstract & Title
   most important for first impression
   spend time on this,
   try to find an interesting and appropriate title
   and write a concise abstract
### Abstract

- summarise all parts of your paper (write it last) in the order they appear in the text
- it contains
  - the general idea
  - the tested hypotheses
  - the results found
  - the impact of the data
- use term “significant” if and only if statistically significant
- don’t write vague sentences like “the results are discussed”
- the abstract should be understandable without the main text; it should attract the reader to continue reading

### Introduction

- 1st paragraph: start general:
  - what is the general area addressed?
  - why is it important? (rather than giving examples in CS)
  - what is the current knowledge on the topic?
  - give all the relevant literature
- 2nd / 3rd paragraph: get more specific:
  - what is the open question that is addressed?
  - why did you choose the particular study system?
- final paragraph: state your hypotheses (get to it quick)
  - explicitly state your hypotheses and the predictions for your data
- why is your work novel and advances the field?
- dependent on journal: summary of main findings

### Materials & Methods

- state what you did exactly, so that the procedures can be followed by others
  - name standard methods
  - give references for specialised methods
- give the origin of all used animals / chemicals
- give all sample sizes
- name or number the different experiments you did (re-use these terms exactly in the result section)
- add a section on the statistical tests applied and programs used

### Results

- give the results in the same order as the experiments were explained in the Methods section
- present the results as short and clear as possible
- present for each statistical test
  - the test statistic, e.g. t=, F=,...
  - the sample size or degrees of freedom (as subscript)
  - the P value (exact for overall tests; >/< 0.05 for posthoc)
- state the direction of an interaction:
  - e.g. X increases significantly with higher values of Y
  - Not: X depends on Y
- don’t add any interpretation of the data (this belongs to the Discussion)
### Discussion

- Summarize main findings in the beginning of the discussion (many people read this part first)
- Go through your findings one by one (start with the main finding) and discuss their relevance in comparison to other work, not only in your own field of research
- End with a strong note
- Address problems or potential criticism of your work, don’t hope reviewers won’t realize
- Some journals allow an extra Conclusions section (or a joint Results & Discussion section)
  - Check Author Information and recent issues

### Figures

- Already prepare them from the start in a program that delivers formats you can use for submission
- PowerPoint is not very useful (but problems have become smaller > PDF)
- Don’t simply copy & paste it from a statistic package, process it to fulfill journal format criteria
- Check the journal specific style (Instructions and current issues):
  - Arial/Helvetica versus Times New Roman
  - Small/capital letters
  - Line thickness
  - Column size

### References

- Check author guides for number of references allowed and whether to include or not references in the abstract
- Cite old & new, reviews & data papers
- More on literature search & citations from Patrick Danowski

### Tables & Figures

- Each table (with its title) and figure (with its legend) should be understandable in isolation from the text
- Define abbreviations and use full species names at first time mention (even if already in the manuscript)
- All important data should be presented in tables or figures, but not overlappingly in both formats
- Column and row headings of all tables and both axes of all figures should state the units of measurements
- Use standard abbreviations
### Tables & Figures

- Figures should not have "dimensionality" without information
e.g. no 3D bar charts if the depth of the bars gives no additional information
- Create figures that reveal the take home message easily; e.g. don’t add any legend text destroying the visual understanding of the graph
- Ensure all tables and figures are referred to in the text, in the correct order
- Consistently use either “Figure” or “Fig.” to refer to them

### Acknowledgements

- Thank everyone involved in the project, but who didn’t contribute enough for authorship
  (sometimes difficult to decide, discuss this)
- Experimental help, help in the field
discussion & ideas
comments on the manuscript
funding agencies (check Author Information for how much details should be given)
legal requirements

### Other manuscript parts

**Author contributions:**
some journals encourage/require to give information on the contributions of the different authors
- Use this option if you can

**Supplemental Materials:**
depending on length limitations and to improve general readability it may be useful to give
- Details on methods
- Additional data
- Data analyses
in Supplemental methods and figures; if possible Movies

### Data repositories

Journals or Funding agencies require raw data being deposited either before or after publication

**Before:** gene sequences GenBank. Protein sequences...

**After:** all raw data that go into the manuscript, computer codes
- Use existing depositories
- IST repository being built
### Review papers

- read all relevant literature and „on the way“ produce a summary file in which you note a short description of main findings of each paper and some key words (you will have to cite >100 papers)!
  - can be useful for any paper!
- have your reference management files up to date
- sort the references into thematic subgroups
- bring the subgroups into a logical order
- define your major statements and construct a „skeleton“ of your review
- define how much space you will have available for each section before starting to write

### Writing steps

1. make a concept (discuss with others if this is logical)
2. divide the work into different workloads, start easy (Methods, Results) to get into the topic
   - always be aware of how much space you will have available per section
3. write the first draft
4. read it again after two days
5. rewrite until you are happy with a version
   - may still contain comments to coauthors
6. give to major coauthors
7. implement their changes
8. create a nearly final version
9. give to all coauthors for approval

### Before submission

- ask one or two colleagues and a friend outside the field for critical comments on your COMPLETED VERSION
- take them serious and don’t be disappointed if they have problems following your logic – this is what you want to find out
- you don’t need to incorporate all comments, but think about every single one

### Problems

#### How to get started

- think in little steps
- realise this is as important as making the experiments
- plan in time for paper writing
- don’t keep it all until the end of your PhD
- work on the paper continuously, don’t make too long breaks
- discuss with your colleagues or boss

#### How to keep motivated

- think in little steps
- realise this is as important as making the experiments
- plan in time for paper writing
- don’t keep it all until the end of your PhD
- work on the paper continuously, don’t make too long breaks
- discuss with your colleagues or boss

#### How to stick to length restrictions

- think in little steps
- realise this is as important as making the experiments
- plan in time for paper writing
- don’t keep it all until the end of your PhD
- work on the paper continuously, don’t make too long breaks
- discuss with your colleagues or boss

#### How to stick to a time plan

- think in little steps
- realise this is as important as making the experiments
- plan in time for paper writing
- don’t keep it all until the end of your PhD
- work on the paper continuously, don’t make too long breaks
- discuss with your colleagues or boss
### Writing with coauthors

- try to give your coauthors a time plan, when they can expect to see a version of the manuscript
- for this, calculate how much time you typically need to write half a page; check how much space you are allowed to use; calculate an overall time how much time you will need
- **double this calculated time!**
- start early and work consistently on the paper, long breaks make it difficult to come back to it
- be aware that bosses and coauthors may have a tight timetable, so ask them in advance when you could give them the manuscript, and stick to these arrangements

### When to finish?

- only submit a paper when you are really happy with it and like every single sentence in the text
- don’t trust senior coauthors blindly: “I don’t really understand what the senior author writes here, but I believe it will be correct”
  - the corresponding author has to take responsibility!
- discuss until every author approves the text

Check for yourself:

- does the paper contain all relevant information I want to give, and no distracting excurses?
- have I discussed my work broadly enough so that it is of interest also to non-specialists?

### Homework

Correct the last homework by your table neighbour

Criticise and correct the sample abstract