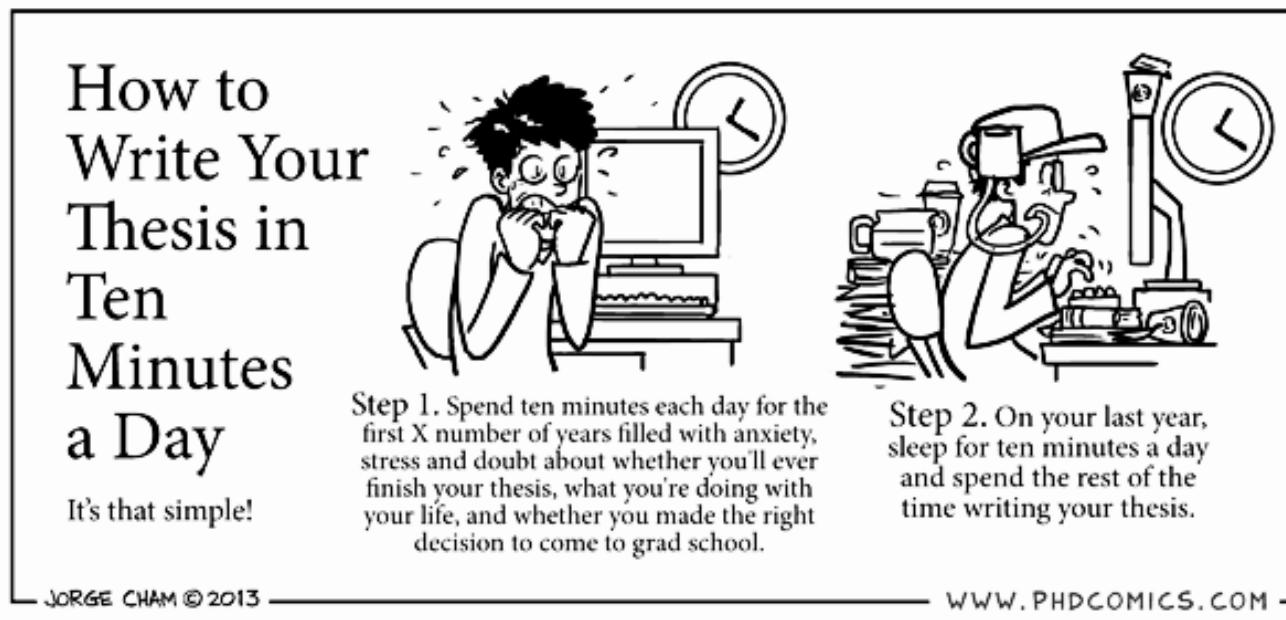


PhD Thesis Workshop

Isla Myers-Smith
Head of PGR Training and Progress

6th February 2020

Aim of session – advice to help you keep on track to timely PhD completion!



Schedule

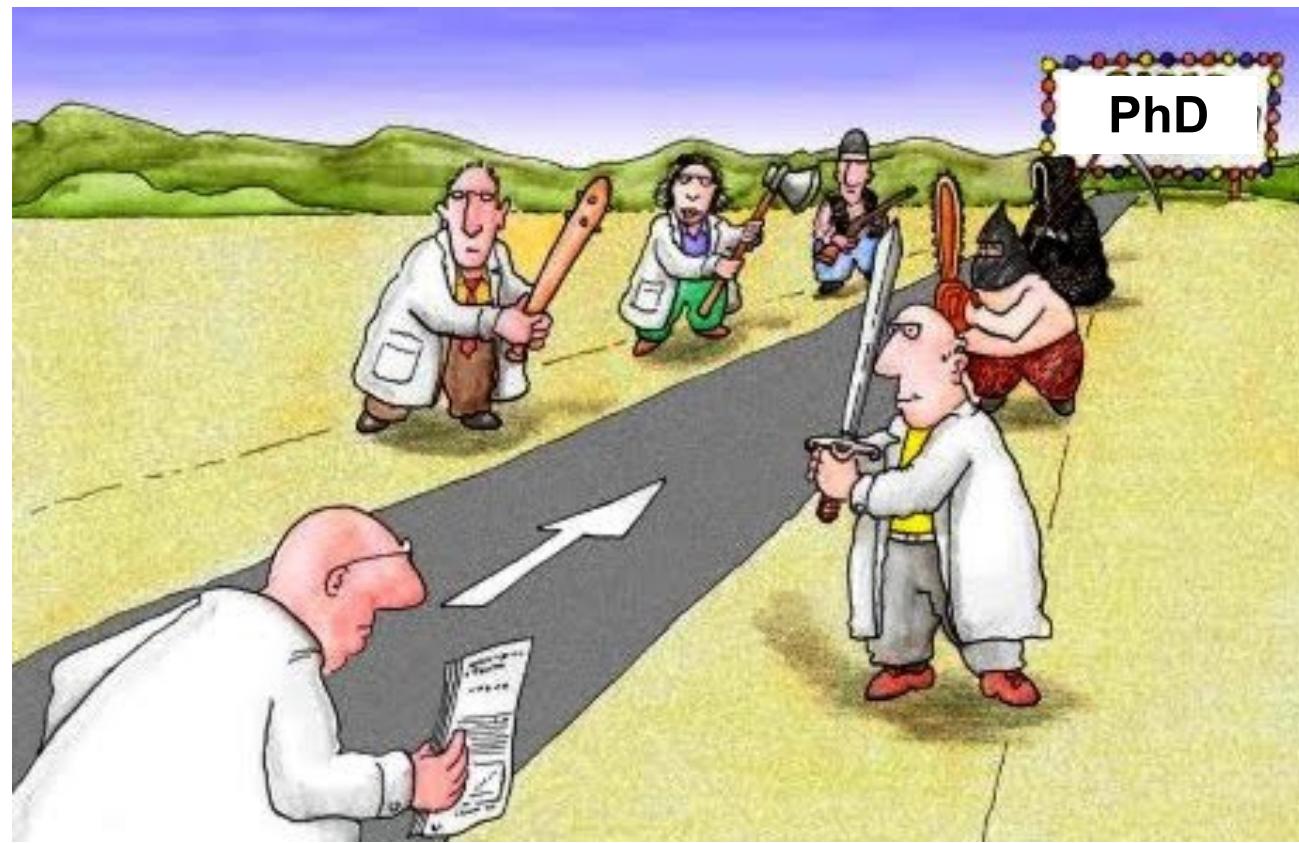
- 13:30 – 14:00 PhD submission and examination process
(Julia Ferguson, College of Science & Engineering)
- 14:00 – 14:45 Content and preparation of the PhD thesis (IMS)
- 14:45 – 15:15 Coffee break
- 15:15 – 16:00 The viva and preparing for it (IMS)
- 16:00 – 16:30 Q&A and close

How do they vary...

by discipline,
around the world,
for each person?



Ph.D. Black cloth lined with blue silk shot with brown, bordered with three inches of red silk



Content and preparation of the PhD thesis

Thesis organisation (conventional)

- **Acknowledgements**

- **Abstract**

A concise summary of issue, aims and achievements.
Use Nature abstract structure – develop a pitch.

- **Table of Contents**

- **Abbreviations**

Detail all of the abbreviations used at the start.

- **Introduction**

Background to topic. Why it is worth doing? What is novel? Your aims and objectives.

- **Methods**

All methodology and materials belong here except cases where you have developed methods significantly and it needs to go in results.

- **Results**

What you actually found out. Present all the evidence for your conclusions. Ensure a logical flow through the ideas and/or experiments.

- **Discussion/Conclusions/Summary**

These could either follow each chapter with a small final conclusion or all be left to the end. If you include them in each chapter be sure to include a final chapter summarising things and covering ideas for future work.

- **References**

Accurate and complete (check your examiners' references!).

- **Appendices (optional)**

Published papers; actual data that may be useful to others; more detail of methods; anything that would detract from the main argument and flow.

School of GeoSciences guidance on including published work in a PhD thesis

This document provides guidance based on the University's formal policy¹ to ensure both students and examiners understand good practice for including published work in a PhD thesis. This document does not replace the University policy, which all students should consult.

Although there is the formal possibility to be awarded a PhD by publications², this is a very specific category aimed at experienced researchers who wish to obtain a PhD based on a portfolio of previous work. However, there is ample scope to include published work in a conventional thesis.

There are **three primary principles** to consider when including material that has been published or is submitted for publication in a thesis:

1. Any material accepted for publication before starting the PhD cannot be included³

Previously published work can of course be cited or quoted in the thesis but cannot be used as part of the research that is examined. This is important to know but rarely causes confusion.

2. Published work must be explicitly declared⁴

A thesis must include a declaration page stating that any included publications are the student's own work and explaining contributions by co-authors. The University provides clear guidance and examples⁵. When a chapter is largely based on a published paper it is good practice to indicate this on the title page of the chapter.

3. The thesis must present a coherent body of work⁶

This principle is open for interpretation, which can lead to confusion and frustration. Our guidance is that chapters can be based on papers but should be adapted to form an integrated part of the thesis.

Minimum expected changes are:

- Removing the abstract, key words and acknowledgements and integrating the references in one reference list at the end of the thesis
- Embedding cross-references to other chapters in the thesis
- Removing overlap or repetition with previous chapters as much as possible
- Explaining the thesis structure and the publication status of chapters in the Introduction

Possible changes include:

- Integrating supplementary material
- Including additional material that could not be included in the original paper

Further considerations:

- If the introduction sections in the paper chapters are too succinct to demonstrate adequate knowledge of the field and relevant literature a dedicated literature review chapter may be required.
- It is good practice to explain the interrelations between chapters and how they address the research objectives, e.g. in the introduction or a dedicated methods chapter
- If the research methods are fully explained in the paper chapters, a separate methodology chapter may not be required or can be brief
- There is the expectation to include a general discussion chapter that cuts across the paper chapters and demonstrates critical judgement with regard to both the student's work and that of other scholars in the same general field

Thesis organisation (as papers)

- Same structure as “conventional” but instead of separate methods and result chapters there will be 3-4 combined methods/results/discussion chapters
- Still needs Introduction and General Discussion chapters
- Papers need reformatting and rewriting so that the thesis “reads as a coherent whole”
- Material can be in different stages of publication, e.g.
 - chapters based on published paper
 - chapters based on paper under revision
 - chapters based on submitted paper
 - chapters not yet submitted for publication

Incorporating papers into the thesis

- Should only include work from papers in which the student's contribution has been **SIGNIFICANT**
- Papers need reformatting and rewriting so that the thesis "reads as a coherent whole"
- **Examples of reformatting/rewriting for thesis:**
 - Give more details than is usual in papers (e.g. of methods, justification of method choice, extended results tables/figures) – similar to Supplementary Information for papers
 - Cross-reference between chapters
 - Remove abstract, keywords, acknowledgements for individual chapters
 - All chapters in same format, all references at end of thesis
 - "I" rather than "our/we"

Research publications vs. PhD thesis?

****See Guidelines on College wiki – PhD & MPhil
thesis submission pages****

- PhD candidates ARE encouraged to publish their research
- Examination for PhD degree assesses – through the PhD thesis and viva - the candidate's ability to conduct a substantive research project
- Aim of College Guidelines is to ensure that the contribution of the candidate is clear in the thesis

Stating the contribution of the candidate

- Declarations in:
 - Appendix to Notice of Intention to Submit form
 - Declaration page at the start of thesis
 - Start of relevant chapters
- Submit copies of the publications alongside the thesis, either:
 - bound in as an Appendix
 - electronic copy included with electronic version on CD
 - DOI
- It is better to over-acknowledge than under-acknowledge

Example of declaration

Declaration

The candidate confirms that the work submitted is his own, except where work which has formed part of jointly-authored publications has been included. The thesis contains four chapters in press or intended for publication in peer-reviewed journals. Details of each proposed publication, including an outline of the candidate and co-authors contributions, are given below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others. No part of this work has been submitted for any other degree or professional qualification.

The candidate, as lead author, performed the experiments and laboratory analysis, data analysis and writing of the paper. Co-authors provided support and guidance on the scope and design of the project, the analyses performed and contributed to the editing of the manuscript.

F.I. Leith, K.J. Dinsmore, M.F. Billett and K.V. Heal, Riparian zone controls on carbon flow in the peat-riparian-stream continuum. For submission to *Hydrological Processes* (Chapter 3).

F.I. Leith, K.J. Dinsmore, M.F. Billett and K.V. Heal, Transfer of CO₂ through the peat-riparian-stream system in an ombrotrophic peatland. Manuscript in preparation, target journal not yet decided (Chapter 4).

Leith, F. I., Dinsmore, K. J., Wallin, M., Billett, M. F., Heal, K. V. and Bishop, K. Carbon dioxide transport across the hillslope-riparian-stream continuum over a full year in a boreal headwater catchment For submission to *Hydrological Processes* (Chapter 6).

In addition to the above, co-authors contributed specialist laboratory and data analysis related to the isotope methods.

F.I. Leith, M.H. Garnett, K.J. Dinsmore, M.F. Billett and K.V. Heal, Source and age of dissolved and gaseous carbon in a peatland-riparian-stream continuum: a dual isotope (¹⁴C and δ¹³C) analysis. In press with *Biogeochemistry* (Chapter 5).

LOOK AT OTHER THESES!



....But be aware that not all past examined
theses will have followed good practice

What makes a good PhD thesis?

- Clear statements of research aims and novelty
- Logical presentation of data, interpretations and arguments
- Well-illustrated with figures and graphs; well-written with no grammatical/spelling errors (beware of ambiguity)
- Conclusions leading to more detailed hypotheses that can be tested by specific further work (the next PhD student)

What makes a good PhD thesis?

- Lack of justification for what you did
- Insufficient analysis (e.g. stats) of available data and interpretation
- Sloppy presentation of graphs and illustrations
- References missing or incorrectly cited
- Grammatical and typing errors

How to get started

- You **HAVE** started already!
- Write out a title page and save the document
- Make an outline plan of chapters and timetable
- Discuss this organisation of the content with your **supervisor before** you begin writing
- **REMEMBER** - You want a coherent story not a historic document, so you rarely present things in the order you did them
- Start with the results/discussion chapter that you feel most comfortable with
- **Refine** chapter plans and timetable as you go

How to get started

- Start with results, it is easier to do the introduction later. **Plan!!**
- Just write - don't spend ages getting each sentence perfect
- Get down the flow of ideas then correct it, but be careful you don't end up with too much stream of consciousness (why you need to plan)
- For the final version, grammar and spelling do matter

Key points to remember

1. Be concise
2. NO WAFFLE
NO PADDING
NO JARGON
3. Discuss with your supervisor if you should include or omit experiments/data/ interviews that didn't work.
4. Ensure your diagrams show exactly what you claim (no imaginary trends, things you see if your photo is held in the right light etc.).
5. Conclusions must be based on evidence.
6. Don't over-interpret data.

How to avoid plagiarism

- Use recognised conventions to acknowledge all assistance in preparation of thesis (e.g. provision of material, assistance with statistics or data processing, external collaborations).
- Editorial assistance from your supervisor and others is acceptable as long as you have generated original text giving the substantive arguments. Acknowledge those that have helped you
- Properly acknowledge and give appropriate credit for all collaborative work
- **It is better to be overgenerous than to risk accusations of plagiarism**

How to keep going

- Find out when and where you write most effectively
- Guard this time jealously – no distractions!
- Have treats and exercise
- It **WILL** be tedious and hard work
- You will not get it right first time

The thesis is **YOUR** responsibility but it is important to interact with your supervisor

- Establish with your supervisor what they will comment on/what format they want material
- You should give your supervisor drafts to read – normally a chapter at a time, with advance warning
- A draft of complete chapters with diagrams is usually better than bits and pieces that are half formulated
- Get a friend/colleague to read it first for grammar, coherence etc.
- Allow time for good feedback from your supervisor
- Ultimately it is up to you to listen carefully and get it right

Getting supervisor feedback

- Remember
 - Your thesis is your first
 - Your supervisor will often have read and examined many

So, if you don't agree with their suggestions discuss them - don't immediately ignore them.

But, in the end it is your thesis and you have the final say. You will have to defend it.

Practical tips

- **Back everything up** on GeoSciences servers!
- Follow University style guidelines from the start
- Keep a list of spelling of terms/formatting styles to maintain consistency
- Use reference management software
- Use a spellcheck
- Allow time for printing

International students

- <http://www.ed.ac.uk/studying/international/english/language-support>
- EUSA proofreading service

Scientific writing

Science Communication 101

- The hook
- Question? - resolution
- Analogies
- Relatable to everyday life
- Social math
- The story arc

How to find the pitch?

1. The hook *Here is what we know:*

2. The knowledge gap *Here is what we don't know:*

3. The study motivation *Here is how we are going to fill this knowledge gap:*

4. The methods *Here is what we did:*

5. The results *Here is what we found:*

6. The take-home message *Here is why we should care:*

<https://teamshrub.files.wordpress.com/2016/03/guide-to-pitching-papers-ims2014.docx>

Nature abstract

Annotated example taken from *Nature* 435, 114–118 (5 May 2005).

One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.

Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.

One sentence clearly stating the **general problem** being addressed by this particular study.

One sentence summarizing the main result (with the words “**here we show**” or their equivalent).

Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more **general context**.

Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (This example is 190 words without the final section, and 250 words with it).

During cell division, mitotic spindles are assembled by microtubule-based motor proteins^{1,2}. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family³. Hypotheses for bipolar spindle formation include the ‘push–pull mitotic muscle’ model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules^{2,4,5}. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled *in vitro* assays that Eg5 has the remarkable capability of simultaneously moving at ~20 nm s⁻¹ towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at ~40 nm s⁻¹, comparable to spindle pole separation rates *in vivo*⁶. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated *in vitro* models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

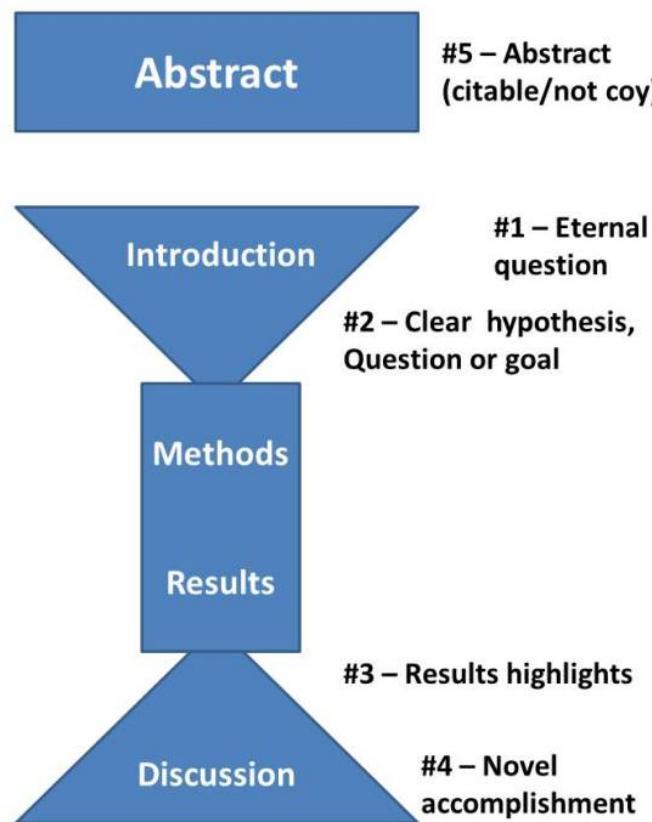
<https://www.nature.com/documents/nature-summary-paragraph.pdf>

Manuscript structure

A manuscript or PhD chapter is like an hourglass or an ink blot – it needs to start with the big picture, get specific, then broaden out again AND the content needs to match across sections – maintaining the same order of findings, but also key paragraphs connect across the manuscript.



The Five Key Paragraphs



<https://dynamicecology.wordpress.com/2016/02/24/the-5-pivotal-paragraphs-in-a-paper/>

Writing backwards

1. List the key findings – one sentence each, order from most exciting to least, or another logical order
2. Make figures for each key finding – place in pre-determined order
3. Write results around each finding – place in pre-determined order
4. Write methods around each result – only include methods needed to describe the science leading to the results presented
5. Write first paragraph of discussion – summarise all the key findings in order
6. Write the last paragraph of the intro – describes the research questions, hypotheses and/or objectives of the study – the study roadmap
7. Write the next paragraphs of the discussion – one paragraph per each key finding in order, discussions often also include a study limitations paragraph and a future research directions paragraph
8. Write the introduction paragraphs – one paragraph per topic of each of the key findings, should match with the content in the discussion paragraphs
9. Write the first paragraph of the introduction – provides the big picture context and sets out the clear knowledge gap of the study.
10. Write the conclusion paragraph – the last paragraph of the discussion or it's own section, should explain why the research matters and put the key findings back into the big picture context set out in the first paragraph of the intro
11. Write the abstract – should include your entire pitch and should ideally follow the Nature abstract structure

How to proof read

Shrubs are predicted to increase in tundra ecosystems with climate warming. In the last 50 years, rapid shrub expansion has been documented in arctic Alaska (Sturm *et al.* 2001a, Tape *et al.* 2006) and the Northern Yukon and NWT (*pers. comm.* Trevor Lantz) concurrent with warming temperatures (Chapin *et al.* 2005, Hassol *et al.* 2004, Stafford *et al.* 2000) and satellite imagery shows a greening of Arctic tundra (Jia *et al.* 2003, Stow *et al.* 2004). The correlation between warming and greening has been used to link climate change with shrub expansion (Sturm *et al.* 2001a, Epstein *et al.* 2003); however, the exact mechanisms driving shrub increase remain unknown. Shrub vegetation plays an important role in climate-carbon-albedo feedbacks protecting Arctic carbon stores (Sturm *et al.* 2001b, Grogan and Jonasson 2006). Changes in tundra shrub cover could release frozen soil carbon to the atmosphere accelerating climate change for the planet as a whole.

Number of sentences: 5

Average number of words per sentence: ~ 15 – 20?

The paragraph starts with a short clear topic sentence

References are in the centre sentences

The paragraph ends with a short clear concluding sentence

Scientific writing resources

[Guide to Pitching Papers IMS2014](#)

[The 5 pivotal paragraphs in a paper – Dynamic Ecology](#)

[JC Cahill's "Finding the "Pitch" in Ecological Writing"](#)

[How to Write Backwards](#)

[Novelist Cormac McCarthy's tips on how to write a great science paper](#)

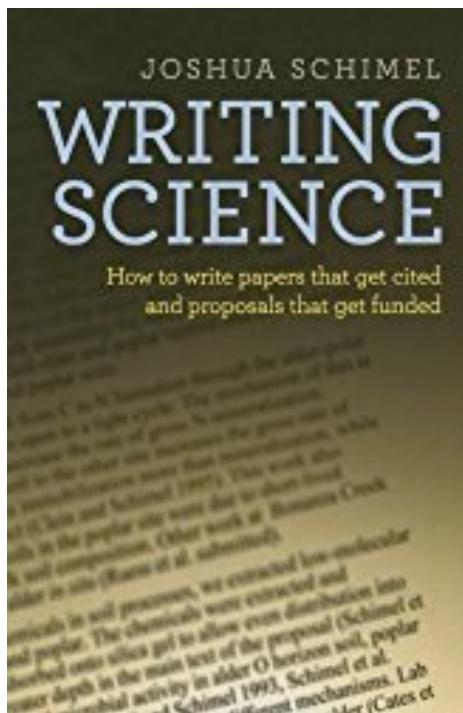
[How to write a paper and the "Nature" summary abstract – Nature Journal](#)

[How to write a paper \(part satire\) – Nature New York Blog](#)

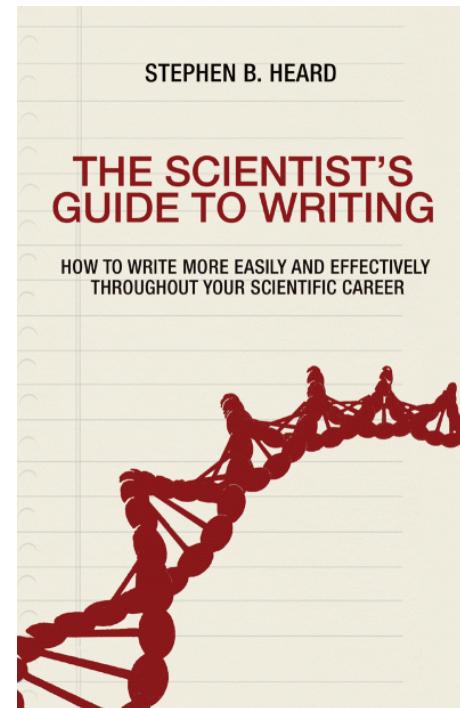
etc.

Scientific writing resources

These are the two current best books on the topic of science writing, if you want to read more.



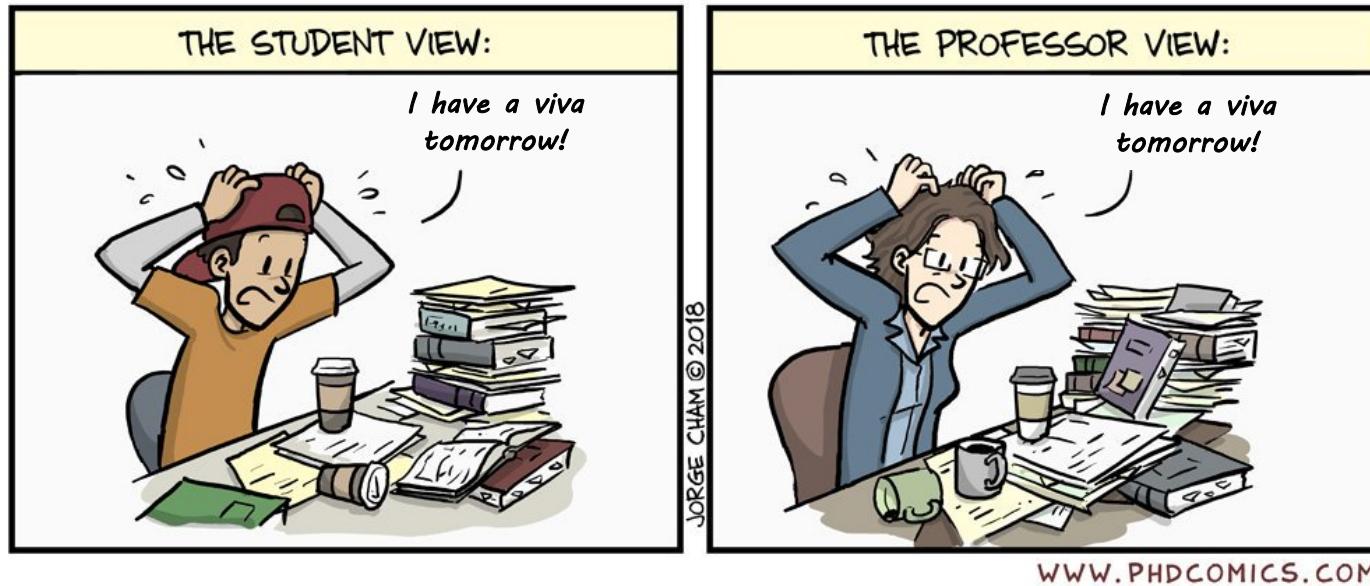
<https://www.amazon.co.uk/Writing-Science-Papers-Proposals-Funded/dp/0199760241>



<https://www.amazon.co.uk/Scientists-Guide-Writing-Effectively-throughout-ebook/dp/B01C4V8RFW>

The viva and preparing for it

Getting supervisor feedback



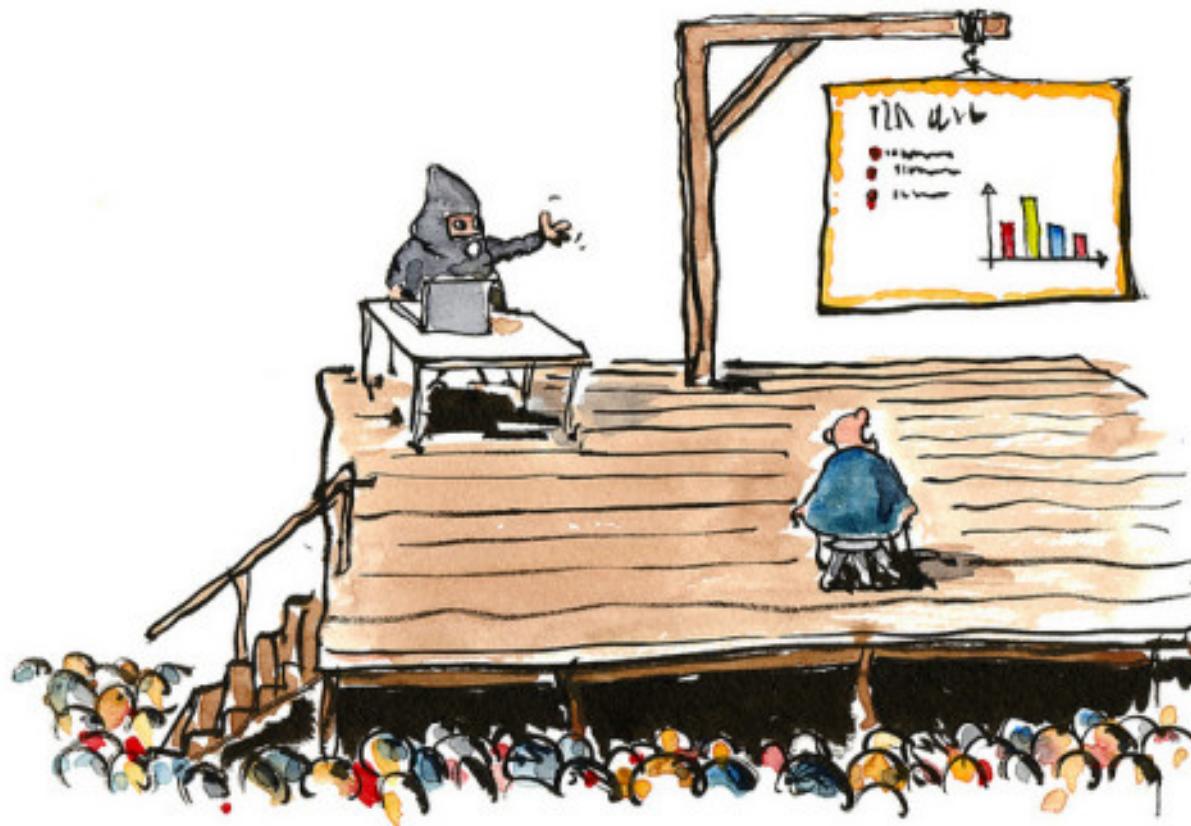
External examiners

- Discuss potential examiners with your supervisors!
- Considerations:
 - People you have met at conferences
 - Future employers
 - Familiar with UK PhDs
 - Travel cost
 - But avoid conflict of interest

Preparing for the viva

- Re-read your thesis prior to the viva and give serious consideration to the main weaknesses therein
- Discuss likely viva questions with your supervisor
- Give a pre-viva seminar to the School
 - ! £50 for drinks from PGR !

During the viva



During the viva

- Supervisor not normally present
- May be non-examining chair
- Bring a copy of your thesis and paper and pen!
- YOU know more than your examiners about what you have done
- RELAX and try to get the most out of your examiners. They can give you useful feedback for writing papers.
- Every viva is different – DO NOT PANIC!
- Expect to be asked to summarise your findings in 5 minutes at the start of the viva
- Normal viva length is 2 to 4 hours; viva length is not correlated with outcome!

During the viva

- Come prepared, but be as relaxed as you can be.
- Do not get defensive, the panel may try to push you to the limits of your knowledge or to defend your work, so they may be looking for you to be clear or to say that you don't know something.
- When you are asked a question that you don't know the answer to – just say that you don't know. You can also start with: "That is a great question, I don't currently know the answer, but one way I could find out would be ..."
- Own your PhD topic and talk with confidence, but be respectful of other opinions in the room.
- Answer questions with short and direct answers and finish with I can provide more information or discuss x or y further.
- If you don't understand a question, or you need time to think, ask for the question to be repeated or repeat the question back in your own words to see if that is indeed what they are asking.
- Bring water or tea and paper and a pen and a marked up copy of your confirmation report!

Examiner's Report Form:

Is the thesis an original work that makes a significant contribution to knowledge in or understanding of the field of study?	YES	NO
Does the thesis contain material worthy of publication?	YES	NO
Does the thesis demonstrate adequate knowledge of the field of study and relevant literature?	YES	NO
Does the thesis show the exercise of critical judgement with regard to both the student's work and that of other scholars in the same general field?	YES	NO
Is the presentation and style of the thesis satisfactory?	YES	NO

Report of Examiners after an Oral Examination for the Degree of PhD by Research

MOST COMMON RECOMMENDATIONS

Options:		Student Action:	Re-examination:
a	Award PhD/Doctorate: student meets the doctorate requirements without corrections.	Finalise hard-copy thesis submission for doctorate degree	Nil
b	Minor Corrections: thesis is satisfactory apart from the rectification of editorial corrections or minor deficiencies.	Make specified corrections within 3 months	Corrections to be certified by the Internal Examiner(s), and by the External Examiner (if requested)
d	Deficiencies in Thesis – No Oral Re-Examination needed: thesis is significantly deficient in one or more of the requirements for the degree.	Complete the thesis revision within 12 months. No thesis resubmission is required.	Revisions are subject to certification by the Internal Examiner(s), and by the External Examiner (if requested)

Report of Examiners after an Oral Examination for the Degree of PhD by Research

MORE PROBLEMATIC OUTCOMES BUT USUALLY OK IN THE END

	Options:	Student Action:	Re-examination:
c	Deficiencies in Oral Examination: student's oral defence of the thesis was deficient in specified respects.	Re-sit viva.	Further oral examination of original thesis required.
e	Major Deficiencies-Resubmission for PhD/Doctorate: Examiners may recommend resubmission within a further specified period of study of no more than 24 months, with reasons stated in their Part II report.	Rectify deficiencies and resubmit thesis within specified period of study of no more than 24 months	Oral examination of the resubmitted thesis required

Report of Examiners after an Oral Examination for the Degree of PhD by Research

AWARD OF MPhil OR Masters by Research

Options:		Student Action:	Re-examination:
f	Award MPhil: thesis is deficient for doctoral award but meets the MPhil requirements without corrections.	Finalise hard-copy thesis submission for MPhil degree.	Nil
g	Award MPhil following minor corrections – No thesis resubmission is necessary: thesis is deficient for doctoral award but student is eligible for an MPhil degree if specified corrections are made.	Make specified corrections within 3 months	Corrections are subject to certification by the Internal Examiner(s), and by the External Examiner (if requested)
h	Major Deficiencies – Resubmission for MPhil: thesis is deficient for doctoral award but it may satisfy the requirements for an MPhil degree if student corrects deficiencies.	Rectify deficiencies and resubmit thesis within 12 months.	Oral examination of the resubmitted thesis required
i	Award Masters by Research: thesis is deficient for doctoral or MPhil degrees, but the work merits the award of Masters by Research.	Nil	Nil

Report of Examiners after an Oral Examination for the Degree of PhD by Research

FAILURE

Options:		Student Action:	Re-examination:
j	Fail: the thesis and/or the student's defence of it in oral examination are fundamentally deficient in regard to doctoral, MPhil or masters standards.	Nil	Nil

Final messages

- Do not leave writing until the end of your PhD
- You CAN submit in less than 4 years
- Write a paper BEFORE the thesis
- The thesis is your responsibility
- BUT communication with your supervisor is important
- Give a pre-viva seminar

**At the end of the examination process
99% of candidates obtain a PhD**

(mostly after completing corrections and modifications
required by their examiners)

Final messages

- Defending your viva is also a great reason to celebrate!



More information

Look out for IAD courses, e.g.,
Preparing for the Viva

More information and booking: <http://edin.ac/13AOtJB>

Questions?