



Your Chemical Science Thesis:

An introductory guide to writing up your research project



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This guide aims to give you guidance on how to write your thesis so that your research is showcased at its best. It includes suggestions on how to prepare for writing up and things to consider during the final stages.

Whether you're researching a new synthetic route to a natural product or applying computational methods to a chemical problem, writing your thesis will be an important task within your research career.

The layout and format of your thesis will vary depending on your university, subject and supervisor; however, some general rules apply. Chemical science theses generally fit within a certain format consisting of three main sections: the 'Introduction', 'Results and Discussion', and 'Experimental Method'. Whilst these are the main focus of your thesis, they will need to be accompanied by a one-page abstract, an acknowledgements page, a bibliography and appendices listing any data or calculations you have not included in the main text.

Depending on your university and supervisor, you may be asked to divide your Results and Discussion section into chapters, each focusing on a different area of your research. For example, if you studied the synthesis of two different natural products, it would make sense to separate them into two chapters to demonstrate your results and discuss your conclusions relating to each.

Remember, you have been researching your subject for several years and you know huge amounts of information about it. You just have to write it down.

Getting started

Environment

Before you start writing your thesis, think about where you are going to work. Whilst sitting in front of the TV with a laptop might suit some people, it may not be conducive to effective writing for others.

You need to write in an environment where you:

- are comfortable,
- are away from distractions,
- have all the information you need within easy reach.

This could be in the library at your university, or you might want to set up everything you need at home. Just remember that preparing your writing space before you start will make it easier to finish.

Preparation is key – try to ensure you have all the research papers you need in advance and collate your data. You don't want to spend time looking through piles of paper, or endless data files, to find the number you need to complete a certain paragraph.

When should I write?

In general, the earlier you begin work on your thesis, the better. This is true even if you have to leave gaps to be completed later on.

Some people prefer to work early in the day and relax later on, whilst others favour night-time working. Choose a method that works for you, and try to get into a regular routine of writing during a set period every day, be it 9–5, 7–2 or 12–8.

Breaks

Studies show that most people can only concentrate effectively for around an hour at a time before their productivity drops dramatically. So, although writing continuously for 6 hours may seem like a great achievement, you are likely to get more done in 5 hours of writing time with regular breaks of around 20 minutes. Some people may need to take a break hourly, others every 2 hours. Find what works for you.

When you take a break, you will find it more satisfying if you actually leave your desk and do something completely different, rather than just surfing the internet. A change of environment will help to clear your head and organise your thoughts for when you return to work. As before, try to get into a routine and stick with it – having a regular pattern of work makes it easier to commit to the task and makes writing less of a chore.

Where to start

Some supervisors like their group to all adopt a similar format and writing style for their theses. If possible, read extracts from other theses from your research group or alternatively, ask your supervisor if you can look at theirs for inspiration.

Prior to starting your thesis writing, arrange a meeting with your supervisor to map out your chapter headings and thesis format. If this is not possible, sketch out your own thesis plan, highlighting the key information to include in each chapter. Discuss your plan with other members of your research group such as postdocs or other PhD students.

Remember to use the expertise around you; academics and postdocs at your university will have all been where you are now. Use their knowledge to help you write your thesis.

When you start to write your thesis, you may find it easier to write the Results and Discussion and Experimental Methods chapters before the Introduction.

Focus on a topic you understand completely initially. Choosing a topic like this will make starting the writing process easier, and will help you develop your writing skills and individual style whilst discussing an area in which you are confident. Writing that first sentence is often difficult but once you start, it does get easier. If you're worried about what to write, try giving yourself a time limit of 5 minutes to write about a specific topic within the chapter.

Don't analyse what you write as you're writing, just focus on getting some words down on paper. Whilst what you've written is unlikely to be perfect, it should give you a start in terms of what you want to write and the angle from which you want to tackle it.

Remember that your final thesis is likely to be very different from your first draft and you should have plenty of opportunities to correct, amend and re-write sections.

Writing up

Back up your work

Remember to back up your work frequently. Save it on your hard drive and to disk, as well as emailing it to yourself at regular intervals. The last thing you want is to spend an hour writing text and creating diagrams only for your computer to crash as you're writing the last paragraph.

Proofreading

Proofreading is crucial to any thesis. After writing the first draft of a chapter, proofread it yourself and make any amendments. Then ask your supervisor or, if this is not possible, a member of your research group, to proofread it and give you feedback.

Make sure you proofread every chapter yourself before asking your supervisor or research group colleagues. Try to leave a few days between finishing writing a section and proofreading it; that way, you are more likely to notice errors you have made rather than just reading what you think you wrote two hours previously.

It's better to correct any errors in style, layout and language at an early stage so you can take this information forward when writing subsequent chapters, rather than having to correct your whole thesis in one go.

You might find it useful to ask a 'non-science' friend to proofread your work as they will be able to focus on the grammar and structure of your work rather than the content. However, remember to take their comments in context as you may have used a certain scientific phrase that makes complete sense within your thesis, but might be completely foreign to a non-scientific audience.

Revising text

It is likely that your supervisor or research group colleague will suggest a wide variety of changes after proofreading your first attempt. Don't be disheartened – the best way to learn is from others with more experience. Talk through any changes with them so you understand why they are suggesting them.

Incorporate any changes as soon as possible and keep suggestions in mind when starting to write subsequent chapters.

Diagrams

Theses often contain a number of diagrams and schemes to describe the complex chemical processes being discussed. When using diagrams, it is important to ensure that they are centred on the page and of consistent size. For example, you don't want a small benzene ring on page thirteen and a huge one on page fifteen.

The most professional looking theses have consistency across their diagrams. Try to ensure the font size and type remain constant as well as the chemical bond thickness and length for example. If you are unsure about how to set these limits within the computer program you are using, refer to the computer program manual or ask your supervisor or colleagues.

Another aspect to consider is whether to use colour or to restrict yourself to black and white. Colour diagrams look great and are often helpful when trying to identify different atoms within a molecule, especially when displaying crystal structures. However, if you are submitting paper copies, you need to bear in mind printing facilities and costs.

If you are using colour, ensure you keep your atom colours consistent throughout your work; it's not ideal having a dark grey carbon on page 47 and a blue one on page 90.

There are a wide range of useful computer programs available to download online; speak to your supervisor about which ones might be useful to you.

Moving forward

Writing the introduction

When you have written most of your Results and Discussion and Experimental Methods chapters, you can start to think about writing your Introduction.

The aim of the Introduction is to give an overview of the scientific literature related to your research, give insight into why you chose your subject area and how it developed from previous research. It should also show how new discoveries that occurred during your research influenced your subsequent work and allowed you to develop your project and its aims.

The Introduction is one of the hardest parts to write because it is not your own work but a summary of work within your research area. Writing it can be made easier by referring to your annual reports, since a preliminary introduction should have been prepared for each of these. If you use words or terms outside of your discipline, e.g. biological or physical terms, make sure that you understand them because they may come up in your viva. The same goes for obscure chemistry from other peoples' work that you include, as this might be discussed during the viva as well.

You will need to refer to a wide range of scientific resources to write your Introduction. For more insight into information retrieval, please refer to the Royal Society of Chemistry publication, 'Key Skills for Scientists: Getting the Message Across' which you can find at <http://rsc.li/transferable-skills-booklet>.

Once again, ask your supervisor or colleagues to proofread this section. They can check for typing errors, ensure you have covered all the necessary information and that you have given an extensive overview of the background to your research.

Bibliography

The bibliography lists all the references you have used throughout your thesis and it is crucial that it is correct, with no missing or questionable information. Follow either the format of the Royal Society of Chemistry or ACS journals when listing your references.

You can find a guide to the Royal Society of Chemistry referencing style on Learn Chemistry at <http://rsc.li/how-to-reference>.

Whichever one you choose, make sure you use it consistently throughout your thesis; don't switch between different formats. Also try to avoid using URLs as references; always quote the original work where possible to ensure accuracy.

Be careful of plagiarism – if you only read things from websites rather than the original papers or books, there is a danger of quoting straight from the screen rather than saying 'Bloggs in his JACS paper claims etc': and thus failing to give 'Bloggs' due credit for the original scientific insights.

Finishing up

The final draft

It is likely that you will revise your thesis several times. However, once you have incorporated all the suggested changes and are happy with the content, you can finalise the text and make sure the document is formatted correctly. Many universities have specific guidelines for this in terms of margins, font etc; make sure you adhere to these to avoid problems with binding and submission.

Once you've done all of this, take the time to have one final read-through to check for accidental typing errors or inconsistent diagrams. Correct any errors you notice then ensure you save the file on your computer and in a back-up location.

It is important to ensure that the length of your completed thesis falls within your university's word limit.

It is advisable to email your thesis to yourself in case you lose your back-up copy as well.

Submission

Universities have different procedures for thesis submission, and some require you to complete an 'intention to submit' form in advance of submission. Ensure you are aware of the process at your university at least three months prior to handing-in.

You need to find out whether you have to submit paper or electronic copies of your thesis, how many copies are needed and the format for binding paper copies. This information should be available in your student handbook, on your university website or from the school office.

Useful resources

If you need more detailed information to help you complete writing up your thesis, the following links and book titles may be useful.

- Vitae – <https://www.vitae.ac.uk/>
A leading world class professional and career development website for researchers.
- LearnerAssociates – <http://www.learnerassociates.net/dissthes/>

Help on writing up from Dr Joseph Levine, Michigan State University. Whilst this guide does have an American style, it is still excellent for principles. It is available in English, Spanish, Portuguese and Arabic.

- Science@unsw – <http://newt.phys.unsw.edu.au/~jw/thesis.html>
A resource from Joe Wolfe, School of Physics, University of New South Wales. This was originally written for graduate students in physics. However, the feedback from users indicates that it has been useful to graduate students in other fields in the sciences and humanities. Spanish and French versions are also available.
- *Authoring a PhD: How to Plan, Draft, Write and Finish a Doctoral Dissertation or Thesis*
Patrick Dunleavy, Palgrave Macmillan, ISBN 1403905843
- *How to Get a PhD: a handbook for students and their supervisors*
Estelle M Phillips and Derek S Pugh, Open University Press, ISBN 0335242022
- *The Research Student's Guide to Success*
Pat Cryer, Open University Press, ISBN 9780335221189

After submission

Viva day

Whilst this day can be understandably stressful, adequate preparation will help you stay calm and ensure the day goes well. For more information on how to prepare for and succeed at your viva, please refer to the Royal Society of Chemistry viva guide.

Corrections

Most people have to make corrections to their theses, as relatively few are accepted without alterations. Take the suggestions of your examiners on board and amend any areas of concern. Although you might not want to do the corrections until a couple of days after your viva, it is worth making a few notes while the information is fresh in your mind. Universities vary in terms of their corrections processes. Your school office, university website or student handbook should have this information.

Proofreading – one last time

This is your last chance to check your thesis, having made any corrections, before submitting it for the final time. Whilst you might feel fed up with reading and re-reading your work, it's worth spending a few moments checking through the text carefully.

Final submission and binding

Universities have different procedures for final thesis submission. You'll need to find out whether you have to submit paper or electronic copies of your thesis, along with how many copies are required and the format for binding paper copies. If paper copies are required, it's common to be asked to submit two bound copies of your thesis. Some universities also ask for a copy of your title page, contents and abstract to be sent to the British Library. This information should be available in your student handbook, on your university website or from the school office.

In terms of getting your thesis bound, universities again generally have their own guidelines for this in terms of fabric, colour, lettering etc. Ensure you check these details before binding as it is often an expensive process and you don't want to get it wrong at this late stage.

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- [Mentoring](#) – Take your professional development further with a mentor, or become one yourself. Discover the benefits of an independent, knowledgeable career relationship.
- [Professional development](#) – Use our online systems to plan, record and reflect on your goals.
- [Professional recognition](#) – Vital to you achieving your career potential, find out more about the range of professional designations we offer and choose the right one for your career journey.

www.rsc.org/careers

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