Tutorial Essays for Science Subjects

This guide is designed to provide help and advice on scientific writing. Although students studying Medical and Life Sciences are most likely to have to write essays for tutorials at Oxford, it is important all scientists learn to write clearly and concisely to present their data and conclusions.

The importance of good writing to scientists

It is not facts themselves that determine how successful a piece of writing is, instead it's the way that you bring them together, how you analyse them, and support them with experiment evidence that counts.

Good technical writing skills are important in all professions: after university, you may find yourself writing to persuade investors to buy shares in your business, writing legal statements for court cases, or writing to pitch new ideas to your boss. Whatever career you choose, you'll find that the ability to write well is one of the most important skills that you'll have developed at Oxford.

Most of the essay writing that Oxford students do is in preparation for tutorials, but you'll also need to write essays in your exams. In the third or fourth year of your course you may be required to submit an extended essay or a report on a research project, which will count towards your final degree classification.

Tutorial Essays

Although the arrangements are different for each subject, in general tutors will try to arrange your timetable so that a tutorial on a given topic takes place a few weeks after it has been covered in lectures.

Your tutor will probably give you a list of books and research papers that they would like you to read before you start writing and they'll ask you to hand your completed essay to them for marking the day before you meet for your tutorial. The tutorial will then explore that particular topic from the lecture course in greater depth, placing the area in a wider scientific context and examining relevant experimental evidence.

You'll be conscious in your tutorial that your tutor with their experience will be approaching the material in a slightly different way from you and that's the great thing about the Oxford system – in tutorials you'll have the opportunity to see how a professional scientist analyses the material that you've been studying and to learn directly from them.

The essay that you write is critical to the tutorial system of teaching. Firstly it gives you a focus and a means of evolving and recording your analysis of a topic; secondly it gives your tutor an opportunity to assess your understanding; but most importantly, the content of your essay will form the basis for the discussion that you'll have in the tutorial. Your tutor will try to begin the discussion at the level that you reached in your preparation, and the higher quality your essay, the

greater the progress that you'll make in the session. The best tutorials are those where the students are well prepared with a solid foundational knowledge.

Planning your essay

You will likely be set your first essay in your first week at Oxford: It's typical to be thrown in at the deep end when you arrive at university, and, because our terms are so short and concentrated, your lecturers will want to start serious work as soon as possible.

Your tutors will have high expectations of you, but they will also be well aware that this is your first attempt at writing an undergraduate essay – so don't worry, give it your best shot and be prepared to learn from their feedback. Most importantly don't panic: tutorial essays don't contribute to your final degree classification, they have been set to help you to explore the subject, so you've got the freedom to try out new ideas and writing styles.

You'll probably have four or five days to write your essay. The first thing to do is to make sure that you understand the title, and in particular try to write concise definitions for each of the key terms. Make a start on your reading list, tackling the more general textbooks first (to give yourself an overview of the topic) and moving on to more specialized books, review articles and research papers later. Take notes as you read, but bear in mind that not everything that you read is going to be necessary for the essay. Often the skill in planning an essay is in deciding what information to leave out and what to include. Remember that your essay won't just be a list of factual statements, you're looking to identify the key principles and to illustrate them with examples and evidence.

Often the hardest part of writing an essay is working out how and where to start. Sometimes the best way of getting round this problem is to start in the middle, focusing on the part which has the most obvious linear structure, and then coming back to untangle the knottier parts later.

Here are some things you might want to ask yourself when planning your essay:

- *Which key words do I need to define in my introduction?*
- *What is my paragraph structure?*
- *What level of detail am I going to need in each section?*
- *Which diagrams am I going to draw and how will I link them with my argument?*
- *What experimental evidence am I going to include?*
- *What am I going to say in my conclusion?*

It is also a good idea to be aware of the marking criteria that are used to grade Prelims and Finals essays, as successful tutorial essays will share many characteristics of good exam essays.

Writing about experimental evidence

You need to make sure that your essays are not simply descriptive, it's important to know not only the facts about a particular scientific phenomenon, but also

how those facts were discovered. You need to become familiar with the way that experimental methods work, the limitations of various techniques and, most importantly, how the data generated is processed and analysed.

Your knowledge of experimental methods will become more detailed as you progress through your course, but as a first year student you should aim to include information about two or three major experiments in each essay. For example if you're writing an essay about semiconservative replication of DNA, you might want to describe the Meselson and Stahl experiment, which uses isotope labeling. When you're writing about experimental evidence, the key is to focus on the data that have been produced and the interpretation of that data, rather than a detailed description of the method.

It's important to be aware of the context of the specific area that you're studying, in particular how different ideas relate to each other and how a particular field has developed over time. You need to be a little careful here, as there's a balance to be struck, and your essay needs to avoid turning into a historical narrative. This is one aspect of your writing that you'll need to fine tune with the help of your tutor throughout your time in Oxford. It's also worth noting that attitudes to theories, models and experimental methods change, something you may notice when comparing your lecture notes with older textbooks.

A good initial starting point for finding the balance between wider context and emphasis on the specific topic is to make sure that the majority of every paragraph directly relates to, and helps to answer, the specific essay title.

Writing Style

Many first year students are a little anxious about their writing style when they start to write essays. There's a misconception that academic writing needs to sound 'intellectual' using long, complicated words and even longer, more complicated sentences. In fact the best scientific writing is concise and straightforward – the reason that non-scientists might find it difficult to understand is in its precise use of terminology, rather than because a complex sentence structure.

You should aim to develop a scientific writing style that is:

- *Clear, concise, simple and direct*
- *Unambiguous*
- *Analytical and critical*
- *Logical*
- *Not historical*
- *Using scientific conventions correctly*

Many of you will have read books by George Orwell including *Animal Farm* and *1984*. In 1946 Orwell wrote an essay called "Politics and the English Language", which included six rules for writing clearly and concisely. I want to focus on three of these rules, to show you how they apply to scientific writing:

1. ***Never use a metaphor, simile or figure of speech which you are used to seeing in print.***
   Avoid terms such as:
   - The nucleus is the nerve centre of the cell
   - Adipose tissue is the storehouse of the body
   - Chlorophyll is the molecule of life
   - This analysis opens the door for…

2. ***Never use a long word if a short word will do.***
   - use *not* utilise
   - before *not* prior to
   - after *not* subsequently
   - have *not* possess

   But never replace a word with a narrow scientific definition with a word with a broader common definition.
   - concentration *not* level
   - aqueous *not* watery
   - hydrolysis *not* breakdown
   - homologous *not* similar

3. ***If it is possible to cut a word out, cut it out.***
   - *'X is true* to a certain extent*', should be 'X is true'*
   - *'Y,* in terms of size, *is small,' should be 'Y is small'*
   - *'The specimen is* quite *unique,' should be 'The specimen is unique'*
   - *'It* would *appear that…,' should be 'It appears that'*

During your preparation for your admissions interview you will probably have read articles about science in newspapers and magazines, as well as popular science books. It's important that you realize that there is a distinction between writing for non-specialists and the style that you will need for your essays. In explaining scientific discoveries, popular science writers and journalists want to:

- Communicate broad themes rather than precise detail
- Simplify complex concepts
- Capture the human impact of the discovery
- Capture the personal journey of the scientist
- Create a mental image in readers' minds
- Avoid mathematical descriptions
- Entertain the reader

In fact what you want to aim for in your writing as a scientist is close to being the complete opposite! In particular you should aim to:

- Present complex concepts clearly, but not by simplifying
- Focus on scientific detail and not the historical context of the discovery
- Draw annotated diagrams to illustrate your argument
- Be quantitative and use precise mathematical descriptions
- Your tutor doesn't need to be entertained!

Setting out your essay

Pick up any scientific textbook and you'll see it's divided into sections with subheadings and is illustrated with diagrams. It's a good idea to try to emulate this layout in your writing. By using subheadings to separate sections, you're not only helping yourself to structure your writing, but also making it easier for your tutors (and examiners) to follow your argument.

Tutorial essays must contain diagrams. Not only do they to help illustrate your argument but more importantly they will save you time – the old saying that 'a picture is worth a thousand words' holds true for scientific writing. Don't forget that in an exam you will be writing under considerable time pressure, so you should take advantage of any strategy that will enable you to communicate concepts efficiently.

Diagrams are particularly helpful when it comes to presenting experimental data – it's very easy to sketch graphs, spectra, and other data – and will communicate these ideas more efficiently than a paragraph of writing.

Diagrams should be:

- *LARGE*
- *drawn in pencil*
- *titled*
- *correctly labelled*
- *fit into the text of your essay (e.g. "Fig 1 shows…")*

When you're labeling your diagram, only use arrows to show direction of flow of fluids such as blood or water, otherwise just use a plain labeling line.

If you are typing your essay on a computer, always leave space for your diagrams and draw them in after printing. Some diagrams require a little skill to draw and it's a good idea to practise before you have to draw them in an exam.

Presentation

Your tutor may tell you whether they would like you to write your essays by hand or to type them on computer, but they may leave the choice up to you. It's certainly true that word-processing gives your work a more professional finish and allows your more scope to reword and redraft sections as you go along. But the ability to re-edit is a bit of a double-edged sword and there's a lot to be said for the discipline that writing by hand imposes.

Hand-writing forces you to make sure that your ideas and essay structure are in place before you start work and gives you little scope for changing wording and layout – you need to get it right first time.

There's a particular danger of unintentional plagiarism when working with on-screen electronic resources and it's very easy to get into the bad habit of cutting-and-pasting directly into a word processor, rather than rephrasing and

integrating material with other sources.

Don't forget that, unless you have special permission, you'll be required to hand-write essays in your exams, and although you're not under the same time pressure, hand-writing tutorial essays in a single concentrated session is excellent training for Prelims and Finals.

At the end of the day it's important to remember that your essay will be judged purely on content and not on presentation. If you do decide to type your work, do leave generous margins and line spacing, so that your tutors can write comments alongside specific paragraphs.

Acknowledging sources

In the first year your tutors and lecturers will generally give you a list of books and articles to read to help you to research your essays. It's important to start to acknowledge the sources of the information that you're using, so you need to make sure you record this when you're working through the reading list.

For most first year essays all you need to do is record a short bibliography, just a list of books and papers, at the end, but check with your tutor at the start of each set of tutorials if this is the method that they prefer.

Tutors are generally pleased to see students using resources, which haven't been given in reading lists, but be careful! Some published resources, including many Internet sites, have not been reviewed by professional scientists and are not sufficiently detailed or trustworthy to be used for academic study. If you include information from a source not on your reading list make sure that you reference that source either in the margin or at the end of the essay; your tutor may want to check the information themselves before the tutorial and may want to discuss it with you.

Longer essays, theses and laboratory project reports, which you submit later on in your course (normally the 3rd or 4th year), and which will actually count towards your final degree classification, will require a stricter use of references and your examiners will want to see full use of inline citations. Your tutors and lecturers will give you advice on reference formatting at the appropriate time. Further information is available in the University's Plagiarism Policy and in the online course on avoiding plagiarism.

Checking your work

You won't have time to draft and redraft your essay before your hand it in for marking. However, you do need to make sure you read your essay through before the tutorial. If possible give yourself an overnight break between writing and reviewing, so that you approach the essay again with a fresh mind.

Things to check are:

- *Whether you have answered the question*
- *Spelling and grammar*
- *The coherence and logical flow of the argument*
- *Whether the argument is supported by sufficient and appropriate evidence*

Where do tutorial essays typically go wrong?

- *Answering a different question to the one set*
- *Answering half the question*
- *Writing about the general topic area rather than addressing the question directly*
- *Getting sidetracked by a tangential issue*

Thorough planning should help you to avoid most of these issues.

Stress

There's no doubt that doing an Oxford degree is very demanding. You'll be academically challenged more than ever before and forced to think on your feet in tutorials. It's inevitable that you'll feel stressed and under pressure during your time here and you may already have heard other students talking about 'essay crises'.

It's true that some people find that they work best under the pressure of a deadline, but most perform at their best when they are relaxed and have plenty of time to research their material properly.

Planning, reading and writing simultaneously is never a good idea, but it is advisable to try to write tutorial essays in a single, concentrated session. You may find working in the library, seeing other people concentrating, helps to motivate you or alternatively you may find that working in your room is less distracting. Find whatever strategy works best for you and stick to it, and, if you do find yourself falling behind, speak to your Tutor as soon as possible – they are there to help you.

Exam essays

Many of the themes that we've discussed for tutorial essays are equally true of exam essays. There are a few added pressures, you'll have a restricted amount of time and you won't have your notes and reading material with you. An added complication is that you'll be required to write by hand unless you have been given special permission to type your answers.

A common mistake is to feel that you need to start writing as soon as you turn the paper over. Students who do this might fail to properly read the question or skip the planning stage altogether, this leads to poorly structured essays that will not score highly. Another trap that students often fall into is answering a question that they want to answer rather than the one on the exam paper.

Preparing for exams is essential. As well as revising the material you have covered in your courses, it is a good idea to:

- *Familiarize yourself with the marking scheme used to grade essays early on in the academic year – good tutorial essays have much in common with good exam answers.*
- *Practise writing under timed conditions. Writing several hour-long essays in each exam can be very tiring and it's important to build up the stamina that you will need. Most importantly, the process of writing without your notes will reinforce your knowledge and will highlight areas where you need to do further work.*

Conclusion

There is no magic formula for writing a good essay. The exact requirements will vary between subjects and your tutors and lecturers will provide more detailed guidance.

Considering everything this document has covered, you may want to follow these three steps for essay writing:

1. ***Before you start***
   - Understand the question
   - Read and research from a variety of sources
   - Analyse experimental evidence and data
   - Plan your paragraph structure
2. ***During writing***
   - Define your key terms in the introduction
   - Write clearly and concisely
   - Draw relevant diagrams by hand
   - Conclude by returning to the title
3. ***After you have finished***
   - Check your work thoroughly before you submit it
   - Reread your essay after the tutorial in the light of your tutor's comments

There are many useful books about essay writing. Texts you may find helpful include:

- *Essay Writing Guide: Colour Edition; Lindon; Stepahead Press, 2012*
- *The sciences good study guide; Northedge and Thomas; Open University, 1997*
- *How to write better essays; Greetham; Palgrave, 2008*
- *How to write critical essays; Pirie; Routledge, 1985*
- *The good study guide; Northedge; Open University, 2005*
- *Practical skills in biomolecular sciences; Reed; Pearson/Prentice Hall, 2003*