

HOW TO DO RESEARCH

This document gives an overview of how to get a Ph.D. Some of the ideas will also be relevant to students studying for a masters degree with a research component. It is based on the experience of various fellows of Queens' College Cambridge. Some expert researchers may disagree with parts of it. This does not mean that any of us is wrong. There are many different effective ways to do research and, in the end, you will develop your own approach. You may however find this document a useful guide in the early stages.

1 Starting out in Research

1.1 The Good News about Research

- You can work on a topic that interests you.
- You can usually choose your own work hours and work regime.
- In some subjects, particularly in the sciences, you may find yourself working in a group with other bright imaginative people. This is very stimulating and will help you give your best.
- You often get a chance to solve a problem properly, from beginning to end, rather than working toward some more pragmatic commercial goal.
- You get a tremendous sense of personal achievement when the Ph.D. is complete.

1.2 The Bad News about Research

- You are probably going to have to work harder than you ever have before, harder even than you thought you were capable of. Research is 90% perspiration and 10% inspiration.
- The hours are long too. Suppose the week is split into 21 four hour sessions. Effectively morning, afternoon and evening on each day (including the weekend). You will probably have to work 15 or more of these sessions, i.e. at least a 60 hour week.
- Your Ph.D. is your responsibility. If you overrun it looks bad on your C.V. and no excuses can avoid this. You must take control right from the beginning and make sure that the outcome is a success.

1.3 Choosing your Research Topic

- Picking the right topic to address is probably the hardest part of research. Some topics are easy to address and produce good material to write up. In the sciences, some topics comprise problems that are impossible to solve, given the current state-of-the-art. In the arts, it is more the state-of-the-debate that governs which topics can be sensibly addressed. Give yourself time to read around the field and develop a view of the current position before you try to pick your topic.
- In some scientific subjects you may be able to pick a problem that can be solved at a number of levels, from very general (hard) to completely specific (easy). This is a

considerable advantage as you can then develop your research toward a range of goals. Whatever happens, you should be able to solve the specific case and will have something to write up.

- Some inexperienced researchers believe that if a problem looks soluble then it will not be “original enough” for them to address. This generally means they try to attack a problem that is not immediately soluble — and very often, as a result, they fail to solve it. Pick a problem that you are confident you can solve to some extent. The way you address the problem can help. Try to make your research into an investigation where both a positive and a negative result will give you something useful. That way even if your proposed solution does not work (i.e. the negative result), you still have something to write up.
- In the sciences, don’t base plans on any facility or equipment that you cannot see in front of you. Don’t believe your supervisor if he/she says that machine *Y* will be bought soon and you should plan to use it in your research. In the arts, it is best to design a project that can be accomplished largely on local scholarly resources. Some projects inevitably involve fieldwork or work on sources away from Cambridge. But make sure that Cambridge has at least the library and personnel back-up to support your preparation for work elsewhere, and your work on material brought back here.
- Talk to people. However brilliant you may be, feedback from other people is always helpful. Remember that this is one of the most prominent Universities in the world and there is knowledge and expertise all around you. If you do not benefit from this then you have not made the best use of the opportunity before you. Talk to your supervisor. Talk to your contacts, don’t be afraid to ask them about what they know, and try out ideas on them. This will help you to judge the best topics to address as you progress through the field.

1.4 Research Technique

- Write early, write often. The precise strategy will depend on your field.

In the arts it is important not to fall into the trap of believing that you do the research first, then write it up at the end. Arts Ph.D. students usually write rather longer theses than scientists, and the writing is, to a large extent, the thinking. When you write up a topic or an argument, you will find gaps and open up new lines of thought which in turn call for further research. Start writing as soon as you have something to say — it not only hones your writing skills, but also maximizes your scope for improving the final thesis.

A scientist might publish a piece of work first as a departmental technical report, or as a group presentation, then in a concise form as a conference paper or abstract, and finally in full as a refereed journal paper. The technical report can be produced quickly and date-stamps the work as yours at an early stage. The journal paper may take up to two years to appear in print.

- Don’t get side-tracked doing “displacement activities” that use up your research time. The classic trap for scientists is to become obsessed with managing computer systems or other administrative tasks. Such activities may be helpful to your department, but may jeopardize your PhD. Quite a few people in Cambridge have failed to write because they have been diverted into such a ‘side-line’.
- Keep to a structured work regime. With so much work to do, and no fixed hours, there is a temptation to work randomly at all hours of the day and night. This is not efficient, and tends to jeopardize the little social and sporting life you have left.

- Be aware of the nature of your goal right from the beginning — check out what a Ph.D. (or M.Phil.) thesis from your group looks like.
- Imagine all possible knowledge is a flat surface. That which we know is symbolized by a big blue blob in the middle. The edge of the blue blob, where it joins the rest of the plane, is the limit of what is known. Doing a masters degree is like taking a single step out from the blue blob into the unknown. To achieve this you need to find the boundary (become aware of the state-of-the-art) and then take a carefully considered step beyond it (discover new knowledge). Doing a doctorate requires you to take a step into the unknown (like for the masters) and then build on your first step to take a second further step. This analogy helps to emphasize the importance of knowing the boundary beyond which you must step, i.e. knowing the state-of-the-art, and making each step as secure as possible by publishing it and discussing it with other people in the field (not just your supervisor).
- Expect to have to do everything for yourself. For example, if some key literature is available only in Russian you will either have to arrange to have it translated (try asking the Cambridge Philosophical Society for a grant to cover part of the cost), or you will have to learn to read Russian. If a piece of equipment you need does not exist in Cambridge you will either have to work out how to do the research without it, or change the topic of your research so you don't need it, or find one somewhere else in the world and negotiate access.
- Actively manage your time. Make lists and prioritize your activities. This will help you to avoid spending too much time on any given strategy, which may turn out to be a “dead end”.

2 Help

2.1 Your Supervisor

- You should expect your supervisor to be available when needed. This does not necessarily mean a regular meeting each week, but means that he or she must be truly interested and supportive of you and your research, and available to meet at sensible intervals. Do not assume however that these meetings should be arranged just to your convenience. It is important that you both arrange a mutually convenient time when the meeting is not likely to be disturbed. It might be worth establishing early on a regular basis for meeting, whether weekly, fortnightly, or less frequently. Remember that your Supervisor has many responsibilities in addition to your studies. He/she has to balance these commitments to include the teaching, research, grant writing, reporting and dissemination activities that are all part of the job.

If your supervisor is always flying round the world to conferences and busy running companies rather than taking an interest in the research group then you may have a problem, but be careful in your judgment. Remember that it is important for your Supervisor to retain and promote an international profile and reputation. This is also to your benefit since he/she often has the opportunity to disseminate your work and raise your reputation.

- You should expect your supervisor to help you start out your research in the right direction. However, by the third year of your Ph.D. you will hopefully know more about your specific topic than he or she does. If you do not, then you probably haven't given enough attention and effort to your research. As your research progresses you will therefore have to take increasing responsibility for managing your own work.

- Your supervisor can expect you to work hard at your research; at least 60 hours a week, for someone of average ability, as described above. If you do not work hard then you cannot expect your supervisor to find a way to transform your failure into success. Laziness also tends to make your supervisor lose interest in your research.
- You can expect your supervisor to read and comment on every paper you write. You can expect him or her to read your dissertation twice, once as you write each chapter, and again when the whole thing is completely finished. In some arts subjects it is normal for the supervisor to read thesis chapters in draft as well as in their final form. Your supervisor should provide this feedback relatively promptly, say two weeks for reading a paper or thesis chapter.
- If you think you have a problem with your supervisor, a good first step is to talk to your tutor. Your problem no doubt feels unique to you, but your tutor may well have seen a similar difficulty in the past and may be able to suggest a simple solution.

2.2 The Wider Research Community

- Scientists should talk to the other students and post-docs in their research group. Research can be a more lonely/solitary experience in the arts, where most are not working in teams, but solo. It is important to find out about, and attend, relevant seminars, and to work on building relationships with others working in or near your field. In some Faculties, one seminar may be compulsory, and you should make full use of the opportunity this provides. Share your ideas, don't be frightened of other people pinching them. You will gain much more from interacting with your peers than you will by keeping everything to yourself.
- Use publication through seminars and manuscripts as a way of getting feedback on your work. The format will depend on your field. In the sciences, you might present a paper at a conference early in your studies, as a way of getting as many people as possible to give a view on the approach. You will also write journal papers toward the end of the Ph.D. to get the benefit of the detailed critique provided by anonymous referees. In many arts fields, there are regular conferences for Ph.D.s and younger scholars, which can be a good place to make preliminary presentations about your work and findings.
- If at any stage you feel you need more feedback, find a way to get yourself invited to give a research seminar to a group who do work in the same field at another university.
- Whatever you do, make very sure that the first detailed feedback you receive from outside your group is *not* your Ph.D. viva.
- Get two friends to read your draft Ph.D. as well as your supervisor. One of them may not be an expert in the field (perhaps your partner?), the other should ideally be from your research group.

2.3 The Literature

- Two hours spent in the library now may save two months or even two years of wasted effort later. Be sure that nobody has already done what you propose to do, and make sure there aren't good reasons as to why you should not try.
- It is hard to use the literature effectively. Put effort into learning good techniques: from library staff, from your supervisor and from your peers. If you are new to Cambridge

(and even if not), attend the introductory sessions at the University Library (UL). If you cannot find something in the UL, *ask*. The older catalogues can be baffling, and the UL has many resources which are not immediately apparent. You can often obtain things by inter-library loan, and the UL still has a reasonably generous budget for buying specific foreign books.

- Read with a specific goal in mind and make notes as you read. Don't just wade through a large numbers of papers superficially and indiscriminately.
- Find out what format people in your group or field use to record citations. Begin to create an annotated list of citations in this format from the very start of your research. Keep full and consistent bibliographical records of what you read. This can save an enormous amount of frantic last-minute effort.
- Consider joining a *reading club*, where a group of students gather each week to discuss a recent relevant paper.
- Identify the key journals in your field, and keep an eye on the recent issues.
- Through the UL or your department, you will have electronic access to many journals. Investigate these, and find out which search engines your colleagues use to monitor the literature.

3 Ph.D. Timetable

Different faculties and departments have different ways to structure the various stages of the Ph.D. degree. The pattern below should be regarded as an illustration of the sort of things that happen at each stage, not a comprehensive list. You should find out what goes on in your faculty at an early stage in your studies.

3.1 First Year

- Find out which the key conferences are in your field. At what time of year do they normally happen, and when is the paper submission deadline? Also make a note of the form in which papers should be submitted.
- Learn the word-processor in which you will probably write your dissertation. You should use the same one to write your papers as this will make it easy for you to re-use material.
- Find out what funding is available to pay for you to visit other groups and go to conferences. Your College will have some funds, but there is often other funding available through your Department.
- Investigate learned societies in your field. Many have associate or student membership which may give access to travel and other funds, as well as providing a forum for you to present your work.
- Read the literature, and with the help of your supervisor, choose a research topic for your first year's work.
- Students in the arts should be starting to write the document that will eventually become their Ph.D. dissertation, right from the beginning of their work. In many science subjects

students will should write and submit a conference paper by half-way through the first year.

- All students should try to attend a national or international conference, meeting or workshop toward the end of their first year, whether or not they are in a position to present their work there. This is a very effective way to get a feel for the subject area in which you are working.
- Most faculties require candidates to produce a piece of work to be formally assessed toward the end of the first year. Make sure you find out as soon as possible precisely what is required of you, and when it should be submitted.

3.2 Second Year

- In the light of what you learned at the conference, and in consultation with your supervisor, come up with a plan for the rest of the research you are going to do.
- Some science departments require students to prepare a poster or web page on their work during the second year.
- Plan to do the majority of the work for your Ph.D. this year. Scientists should also write two journal papers. Those working in the arts will give a seminar or conference presentation.
- Expect some trial-and-error at this stage of your research. As you gain in experience you will learn to adopt lower risk approaches and will make more progress.

3.3 Third Year

- Arts students will have been writing their dissertation from the first year onwards. If you are working in the sciences you should begin writing your dissertation early in your third year. Plan to have it completely finished three months before the end of the third year. You will then have plenty of time to write papers (in the sciences), or develop your dissertation into a book (in the arts). This will also give you some time to spend on getting your next job.
- In the first month or so of your third year you should prepare a plan of your dissertation and get you supervisor to approve it. Then complete each chapter, one by one, getting feedback from your supervisor on each chapter once you believe you have made it as perfect as you possibly can. People generally complete the middle chapters first, then the introduction and literature survey, then the conclusions, then finally the summary.
- Some science departments require the presentation of several seminars and more formal monthly progress reports during the third year.
- In the sciences, you should plan to write two more journal papers this year. Ideally they should contain similar material to two chapters of your dissertation. In the arts, you should give at least one seminar and publish an article, if you have not already done so.
- Expect your research pretty much to take over your life this year. It is not a good idea to try to undertake any other major commitments, for example job-hunting or having a baby (either as a mother or as a father), while you are engaged in finishing your dissertation.

4 Problems

- If you are having problems with your research, you should first make every effort to discuss the situation with your supervisor. Most research problems are most effectively resolved by the student and supervisor working together toward a solution.
- For money problems see <http://svr-www.eng.cam.ac.uk/~rwp/tut/> we keep this up-to-date with all the sources of graduate student funding that we are aware of.
- For personal or medical problems you can contact the University Counselling Service or the College Nurse.
- For other problems, or problems with your supervisor, see your tutor. There may also be a “graduate ombudsman” or equivalent in your faculty or department to whom you can turn for help.