

## RECRUITERS & ACADEMIA

### What makes a good PhD student?

Doing a PhD should be fun and rewarding, because you can spend all your working time discovering things and pursuing ideas — and getting paid for it, without any administrative responsibilities. Those who stick with a career in science do so because, despite the relatively poor pay, long hours and lack of security, it is all we want to do.

Unfortunately most new PhD students are ill-prepared, and as a consequence very few will fulfil their aspirations to be independent scientists. The main reasons for this are the 'grade creep' inherent at most universities, making it difficult to identify the really talented first-class graduates from the rest, and the pressure on universities to graduate as many PhD students as possible. The consequence is that we enrol far too many of them without telling them clearly what doing a doctorate should entail. We therefore set ourselves, and the students, on a path of frustration and disappointment.

So what should we be telling prospective PhD students?

- Choose a supervisor whose work you admire and who is well supported by grants and departmental infrastructure.
- Take responsibility for your project.
- Work hard — long days all week and part of most weekends. If research is your passion this should be easy, and if

it isn't, you are probably in the wrong field. Note who goes home with a full briefcase to work on at the end of the day. This is a cause of success, not a consequence.

- Take some weekends off, and decent holidays, so you don't burn out.
- Read the literature in your immediate area, both current and past, and around it. You can't possibly make an original contribution to the literature unless you know what is already there.
- Plan your days and weeks carefully to dovetail experiments so that you have a minimum amount of downtime.
- Keep a good lab book and write it up every day.
- Be creative. Think about what you are doing and why, and look for better ways to go. Don't see your PhD as just a road map laid out by your supervisor.
- Develop good writing skills; they will make your scientific career immeasurably easier.
- To be successful you must be at least four of the following: smart, motivated, creative, hard-working, skilful and lucky. You can't depend on luck so you had better focus on the others!

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www.qimr.edu.au/research/labs/georgiat/Guideforphds.doc

- Do you really want to get a PhD?
- Do you have what it takes to get a PhD?
- How can you get the most out of joining a PhD program?

From the Queensland Institute of Medical Research website (<http://www.qimr.edu.au/>)

## ***Guide for PhD Students Aiming For a Successful Career in Science***

- Doing a PhD should be fun, rewarding and be seen as a privilege.
- It's the only time in your life that you can spend 100% of your working time learning to do research, finding out new things, having freedom to pursue new areas and getting paid for it, without any administrative or other responsibilities.
- Advancement in a scientific career is like climbing a pyramid: Some people drop out at each step. Your continued advancement is determined by the quality of your c.v.
- What's the best way to approach graduate school to optimize your chances for success?

## ***Choose a Supervisor Whose Work You Admire***

- Find someone doing interesting stuff.
- Search PubMed\* to check their productivity.
- Determine whether they are located in a department or institute with good infrastructure (equipment, patient samples, seminar series etc).
- Do they have enough grant funding to pay the bills?

\* PubMed is a service of the U.S. National Library of Medicine that includes over 16 million citations from MEDLINE and other life science journals for biomedical articles back to the 1950s. It can be accessed at: <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed>

## ***Take Responsibility For Your Project***

- This is probably the most important transition from your undergrad years.
- To be successful in research you need to develop strong skills in independent and effective thinking, critical analysis, problem-solving, and time management. The *only* way to develop these skills is to take responsibility for your project.
- You need to immerse yourself in your research and exercise your mind with every experimental plan and every experimental outcome, including failures.
- If you simply follow directions and close the door behind you at the end of the day you will never progress in research. Tenacity is essential!

## ***Work Hard***

- Don't think you can get away with a 38-hour week. You will need to work long days all week, and for part of most weekends. That gets you to closer to a 50-60 hour week, which is what you need if you want a successful career in academia (or indeed in any professional career).
- If research is your passion, this is actually easy to do. If it isn't your passion, then you are probably in the wrong field. You should be going to work because you want to, not because you have to.
- Ultimately, the number of hours doesn't matter - the only thing that matters is productivity.

## ***Read The Literature***

- Read both in your immediate area, and around it; both the current and the past.
- You can't possibly make original contributions to the literature unless you know what is already in there. See it as a challenge to put an interesting paper on your supervisor's desk before they put it on yours!
- The best time to read papers is between experiments, or in the evenings or weekends. Reading papers at your desk *instead of* doing experiments is a poor use of time.
- Most people find it challenging to understand some papers when they start out. Don't let this put you off. Instead, go back to the earlier literature or text books, ask questions and discuss the papers with your supervisor or other colleagues.
- Use this as an opportunity to spark thought-provoking scientific discussions.

## ***Plan Your Lab Time Carefully***

- If you are in the lab, begin the week, and each day, by carefully dovetailing experiments so that you have the minimum of down time. Multi-tasking is essential!
- Make lists of what you have to do tomorrow at the end of each day while today's work is in your mind. This also allows your mind to think about the next day's work while you sleep.
- Unless you have domestic constraints, be flexible about what time you go home to cope with unexpected changes to this schedule.

## ***Keep A Good Lab Notebook***

- Update your lab notebook every day.
- It will make thesis writing much easier, and will also help to protect any intellectual property that might one day make you rich.
- In particular, write up the details of your methods and results as you go along. They will easily convert to chapters in your thesis, and also to laboratory protocols which will be useful for everyone in the lab.

## ***Be Creative***

- Think, think, and think some more about what you are doing, and why, and whether there are better ways to go.
- Don't just see your PhD as a road map laid out by your supervisor. Talk to your supervisor, and others around you, about alternatives and watch the literature for new discoveries and ideas that are pertinent to your project.
- Probably the toughest challenge for a successful scientist is to be creative, while keeping a sharp eye on feasibility. This is probably the single thing that most distinguishes a great scientist from a work horse.
- Ask Big Questions, and be sceptical about 'conventional wisdom', even if it comes from your supervisor. Don't be afraid to argue with your supervisor on scientific grounds they are not always right and should appreciate the debate.

## ***Be Active, Not Passive, In Your Approach To Research***

- Seek information and advice, and don't assume that it will just diffuse into your head.
- Your supervisor won't know everything (and may be technically less than competent, anyway!), so find the right people for advice and don't be afraid to ask for it.
- Don't go for weeks without talking about your research with your supervisor and other members of the lab.
- If your supervisor doesn't seek you out regularly, go and talk to him/her. When you are inexperienced it is *very* easy to get off track and waste valuable time and resources.
- Students and post-docs who sit back and wait for the magic to happen, or work in a vacuum, never get anywhere.

## ***Go To As Many Seminars As You Can***

- But don't just sit at the back like a sponge, or fall asleep; sit up front and ask questions of the speaker during question time (or afterwards).
- Discuss the seminar with your supervisor and others in your lab.
- Students who speak up in this way gain a much better understanding of their field and are the ones who are really noticed.
- Remember that at this point in your life it is difficult to make a fool of yourself. Just having the courage to speak up is really applauded!

## ***Make The Most Of Any Opportunities To Attend A Conference Or Workshop***

- If you are lucky enough to do so, don't treat them like a holiday; they are *work*.
- Make sure you go to every talk, no matter how relevant you think it is, or isn't. You will always learn something.
- Between talks, use every minute to meet new people, find out what they are doing, tell them what you are doing. Remember, this is where you are most likely to find a good post-doc lab.
- Don't spend all the time speaking only to people you already know or socialising with your lab; you can do that when you get back.
- When you come back, tell your supervisor and others in the lab what you got out of the meeting.

## ***Practice Your Writing In Any Way You Can***

- Most students with a recent US education have very poor writing skills. This will severely impact on your ability to write a satisfactory thesis, get a grant, and get a paper accepted.
- Take a course in scientific writing (if you can find a good one). Use the grammar and spell checks in Microsoft *Word*, try to learn from people around you who write clearly and concisely, and get feedback on everything you write.
- Buy a good book on scientific writing, Like: “How to Write and Publish a Scientific Paper” (6th Ed.), by Robert A. Day and Barbara Gastel (\$29.95 on Amazon.com).
- Try to plan your project so you can get at least 3-4 good (or 1-2 extremely good) papers out of your PhD.

## ***Make The Most Of Any Opportunities To Talk About Your Work***

- Use it as an excuse to read additional papers and to think long and hard about what you have (or haven't!) achieved and where your project is going.
- A shoddy presentation, even at a lab meeting, makes you look bad and is a wasted opportunity. Try your hardest to pre-empt questions that you might get and try to have prepared answers.
- If you don't know the answer to a question, say so; people will invariably see through a ‘bullshit’ answer!
- Talk about your work with family and friends – they sometimes have useful insights (and as tax payers are ultimately your employers).

## ***Think Very Early And Very Carefully About What You Plan To Do After Your PhD***

- If you hope to stay in research you should be aware that you will be judged almost exclusively on your publication record.
- This judgement includes the *number* of papers, your *position* in the author list and the *quality* of journal in which the work is published.
- Without a good publication record your chances of getting a fellowship, or even a position funded by a grant, in research are remote.
- Salaries are hard to come by and are therefore *very* competitive. If there is one job and six (or more!) good applicants, the job will always go to the person who has achieved the most.

## ***Look For Opportunities To Write Small Grants***

- These include pre-doctoral fellowships, travel grants, and small society grants.
- You will learn a huge amount, and you might even get lucky.
- Nothing impresses more than your ability to get your own funding.
- Demonstrating that you can get your own funding during graduate school will set you apart from most of your peers.

## ***Join Professional Societies***

- They all have very cheap student subscriptions, and you will gain something by being involved at any level:
  - c.v. building.
  - cheaper registrations at conferences.
  - getting to know who else is working in your field.
  - a society journal, newsletters etc.

## ***The Bottom Line***

- Ultimately, to be a successful research scientist, you need to be at least four of The following:
  - extremely motivated
  - creative
  - very smart
  - very hard working
  - very skillful in the lab (or at the computer)
  - very lucky
- Since you can't depend on luck, you'd better focus on the others.
- If you don't think you can meet most of the expectations above, this is the wrong career path for you, so think again!

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**A full version of this document can be found at:**

- Queensland Institute of Medical Research website (<http://www.qimr.edu.au/>).
- My website:  
<http://www.microbio.uab.edu/bedwell/Guideforphds.htm>