2.7 Bonus: Wisdom From a Senior Student

Here we include a few bonus words of advice from students who have 'been there, done that'. Much of this has been passed-on through the ages from previous iterations of this publication, but there are also some new nuggets of wisdom scattered throughout.

Managing Upwards

In starting your master's or PhD, you're going to develop a professional relationship with your supervisor, who will help you navigate your research and research project. The nature of the supervisor-student relationship depends heavily on the supervisor: how busy they are, how much experience they've had, how many other students they have, and many other factors. It's important to remember that as the student, it is also your responsibility to 'manage upwards'. Your thesis is the most important academic achievement you've ever taken part in, but you won't be the first or the last student that they have ever taught – your priorities won't always align. More than that, your supervisor won't always be totally on top of where you're at or when you're struggling. You should always be aware that during your degree, you should let your supervisor know when you feel you need help. Try to be on top of managing that relationship to best help your training and your professional development rather than necessarily relying on them to always take the reins.

Initiative and Breaking the 'Rules'

If you have a research idea that you really believe in, *work it through* – even if you have to do this outside your normal working hours. Your supervisor may not believe in the idea straight away, and tell you not to 'waste time' on it. Remember this is not personal: they are in charge of managing your research timeline and are trying to ensure you make the most of your candidature/degree.

Working full-time on your project, by the end of your research degree you'll probably be more of an expert on this work than your supervisor, and you may well be the better judge of the value of your ideas. However, your supervisor is there to make sure your research timeline doesn't crash and burn, so might be more hesitant about new ideas that they are less-than familiar with.

Your best bet to get them on-board is by testing your ideas (within reason) and coming up with a solid 'plan of action'. Through this kind of innovation, you take ownership of the project. If things do work out, you get a great sense of achievement and an original contribution to science – and if they don't, at least you'll know you tried!

Intellectual Property & Keeping Detailed Notes

One of the exciting aspects of research work is producing new ideas to solve long-standing problems. Intellectual property is the currency of science and should be valued accordingly – e.g. one measure of research performance is the number of published papers in refereed journals.

Your ideas will probably contribute to other people's research as well as your own, and it is important to ensure you get adequate acknowledgment for your contributions.

Of course, this goes both ways and it is important to acknowledge the contributions of others in your research, too.

For research students, acknowledgement of contributions is particularly important, as your thesis will be assessed in terms of the 'original contribution you have made to your field'. If someone else has published without acknowledging you, this has an impact on the examination of your work (and on apportioning equity, should the research be commercialised).

Clear and detailed log book records are a very useful way to manage this. Record not only an experimental log, but also ideas, conversations, rough workings and so on. Important e-mails (e.g. outlining the scope of a collaboration) can also be referenced or included. Another benefit of keeping a logbook is that you'll have to produce a thesis at the end of your project. It really helps if you've written mini-reports along the way. Not only as a rough-note log book, but for each idea you work through produce a summary of your approach and findings, with the appropriate references flagged. This doesn't have to be anywhere near publishable standard but it does make things an awful lot easier when it comes to writing-up.

First-Year Floundering

Anecdotal evidence would suggest that many people flounder during their first year of research. This *should be* picked-up by your supervision committee, but often is dismissed until it becomes a bigger problem further down the track. How can this be avoided? Ill-defined goal setting is a supervisor *and* student problem. A project timeline needs to be well-established (e.g. read literature, organise apparatus, gather data, analyse, write up). When students and supervisors fail to do this, there can be a lack of direction and orientation. You should ask your advisor for a rough guide on how long you should spend on each part of a project from the get-go. Sure, this will be subject to change, but this will help you to check-in with yourself during your individual research journey.

Another hurdle could be that the experimental apparatus needed is unavailable, and therefore lead to spending a considerable amount of time building equipment. This sub-project can stretch on longer and longer . . . and the student acquires great lab skills, but does not do enough new science. One way to avoid this is with contingency plans (what if the equipment doesn't work?) and parallel processing other new science (e.g. theory work or simulations) whilst equipment being built.

Both these issues relate to a common problem: the conflicting goals of the student and of the research group. Students need to get a thesis, but research groups need to look at the bigger picture. Students need to remember to keep their goals paramount. Don't be afraid to ask "how will this help me get my degree?" or even "where will this go in my thesis?".

A separate kind of floundering relates to lack of required skills (e.g. programming, electronics, soldering, knowledge of software, even English language skills). This is something that should be assessed by the supervisor early-on, preferably in conjunction with a mentor who has more hands on experience (e.g. a later-year student or post doc who knows just what is practical).

A related problem is the transition from undergraduate to postgraduate. In undergrad, problems are well-defined and solvable, but postgrad research problems tend to

start out as ill-defined and with no "right" answers. In fact, the initial project you start may not even work – and it might take some time before this is discovered. Students are more likely to have difficulty with this than supervisors, and so at an early stage the supervisor needs to provide guidance about how long each part of the project should take and whether any difficulty is a hurdle or a dead-end.

For each of these issues, an important area of skill development is confidence. Develop the confidence to speak up, and even to disagree, with your supervisor about physics. Stand up for your own work in terms of ownership and value. Accept that it's impossible to know everything, and sometimes you will need to ask for help. You are, ultimately, the author of your thesis and the director for your research timeline – so make the most of it!

Random thoughts

- Get to know people all over the department. Don't be afraid to cross group boundaries – it's the only way to get the most out of your time here, and to enjoy yourself along the way.

- Wise postgrads will try to work reasonable hours. You'll find that some people will claim to be 'more dedicated' if they work for longer hours – this is not true! It is harmful to your mental and physical well-being, and it's unnecessary. Of course, one of the perks of the job is being able to set your own hours, but try to aim for a ~ 40 hour week.

- One of the weirdest things about the PhD is the way time works. You will often feel like the project will take the rest of your life. You'll also feel that you'll never have enough time to do it all the way it should be done. You'll frequently feel both at the same time. All you can do is set your goals and try to stick to your plans. You may not believe it, but it does all work out in the end.

- You're doing real research now, charting the unknown, and the sad fact is that it doesn't always work. This is not your fault. The real trick in research is being able to recognise when you've reached a true impasse. Even Einstein had his bad days!

- You're not in control of your data (if you are, you're cheating). Negative results might not be as flashy or publishable, but they're still good science and you shouldn't take them to be any kind of indictment on your research skill.

- The PhD is not your whole life – it's really important for your continuing sanity that you indulge in other personal and professional interests. You're allowed to take holidays and have some playtime. Lots of senior students spend a lot of time sitting around complaining about the fact that a PhD is something you can't 'leave behind at the office', but it's worth trying hard to do so!

- If you get cornered at a party or on public transport by someone you don't really want to talk to, just mention your PhD – it'll work like magic! Unless you're doing astro, in which case you'd better know your star-sign…