

Essential tips for a rock-solid geoscience PhD: Part I

Thinking of doing a PhD? In the first of a three-part focus, Melanie Leng & Anson Mackay explain how to get started on the right foot

Embarking on a PhD is a big decision. It will consume 3 to 4 years of your life, so why do it? Well, maybe because you want to learn more about the world and wish to challenge yourself? Maybe you want to develop as a person and improve your abilities to understand and solve problems? Or maybe you want to become a better communicator, to be able to engage with a wide audience of both experts and non-experts alike. Doing a PhD should increase your confidence and time management. Plus, if you have a lifelong fascination with something in geoscience then you should be able to tailor a doctorate to suit your particular interests. Your PhD could set your future employment opportunities and influence the rest of your life. There's a lot to consider when choosing a PhD, from the discipline and project to pursue, to the university you study at.

Together, we've supervised over 100 geoscience PhD students through to graduation. Our advice is not exhaustive, but it comes from decades of personal experiences as PhD supervisors, as well as from published and on-line observations. There is no doubt that doing a PhD can be a stressful process, and thankfully universities are beginning to acknowledge the scale of the problem. So, take your time choosing a PhD—it's a big decision! Think in advance about your own expectations and those of the supervisor. There are many things to consider, but hopefully some of the advice below will make the experience a more enjoyable one.

Choose your supervisor

It may be a killer project, but it's important to know who your supervisors are. After securing an interview or meeting, do some research. Look up the

potential supervisor(s) and their laboratory or research group via their websites, and online presence. Do they appear interesting and are they doing research that genuinely interests you? Look at how many other PhD students and postdocs there are, and take time to consider the diversity of the research group. Do they look like a dynamic and diverse research group that you would want to feel part of? You may wish to contact current and former PhD students of that supervisor to get a feel for their experiences in the group. You may also want to find out if any staff member in your undergraduate school is in the same field. If so, ask if they know anything about the research group you may be joining (but be mindful, all relationships are different and they might see themselves as competitors).

Which research group does the potential supervisor sit in within the School? Is it relevant to the project? Are there others in the School doing similar research? These may seem like minor issues, but being part of an internal research team can lead to a much richer experience.

If you get an interview, prepare some questions before hand. Ask about the project, the postgraduate environment in the School, how often supervisory meetings will be held, what training and teaching experience will be offered, what the work-life balance culture is like.

You have to spend 3 to 4 years working closely with your supervisors, so make sure you can.

Student-supervisor relationships

In the UK, geoscience PhD students typically have 2 supervisors, but you may also have several more (external/unofficial/collaborators) to cover the many different facets of your research. The first supervisor is usually key and will do most of the supervision and administration.

Ensure you have regular official meetings, at least every few weeks in the early stages. Most universities in the UK require documented meetings every month or so,

and it is your responsibility to arrange these. Many universities now have electronic log books where meetings can be written up and signed off on-line. Try to get your second supervisor to attend, too. Create an agenda before the meeting, write notes in the meeting and type these up as minutes with actions (and agreed deadlines). E-mail the minutes around soon after the meetings. If relevant, upload these into an electronic log. Make sure your (evolving) career goals are regularly discussed with your supervisors.

Doing a PhD can be stressful, and personal support is needed, but keep these supervisory meetings efficient and productive, focussed on the project, especially if more than one advisor is present.

Arrange separate meetings to discuss any personal issues relevant to progress of the PhD (these could also be with your second supervisor or postgraduate tutor). Ideally such meetings should take place before the main meeting, so that any progress and action points discussed are done so with the previous discussions in mind. Informal meetings over coffee are also beneficial.

Your supervisors are not your friends (although your relationship may develop into a close friendship, post PhD). It's probably not a good idea to "Friend" your supervisor on Facebook (or vice versa), at least until you have finished your PhD.

If at any time in your PhD you feel that the relationship with your supervisor is deteriorating, seek advice immediately from your departmental graduate tutor. All universities have clear harassment and bullying policies, often called dignity at work statements, which your departmental graduate tutor will be aware of. Harassment and bullying can take many forms, and knowing how these can manifest is important.

Keeping in touch

If you don't have the opportunity to see your supervisors for a few weeks, then send an





e-mail update. A few sentences are fine, and if you want to cover more than one topic then number the topics. As you become more independent contact time may decrease.

If you e-mail correspond with other supervisors/collaborators, it's a good idea to CC (Carbon Copy) your main supervisor too—a CC link usually means that they don't have to respond. If emailing a large number of people, use the BCC (Blind Carbon Copy) feature. Individual e-mail addresses are then invisible to recipients, preventing unwanted emails that can result from the "Reply to All" feature.

Work-life balance

Most academics consider their work as a vocation. There is a culture of working long hours, although this should not be expected. Be mindful of tight spots in the academic year—periods of exams, marking, heavy teaching weeks, application deadlines. Don't be put off by this culture; you can succeed working 9-5, 5 days a week, but you will need to be flexible when deadlines loom. Many geoscience PhD projects involve fieldwork, which involve longer hours. Bear in mind that coffee/tea breaks are useful for building relationship, as well as discussing approaches and ideas. Time away from your desk can be enlightening. Have regular breaks, but keep them to a schedule.

Taking work home should not be the norm, but deadlines may require it. Sometimes taking a difficult paper or data set home to look at in the quiet and comfort of your sofa can be revelational. Try to be efficient, aim to achieve something every day, even if the accomplishment is small (and write these down to discuss at your supervisory meetings).

Have a life outside of your PhD. Get out at weekends, spend time with your friends and family, participate in a sport or hobby. People who only work, potentially either burn out or are more likely to develop mental health issues.

The mental health of PhD students is precarious: postgraduate students are up to six times more likely to experience depression and anxiety compared to the general population. Your mental (and physical) health

is extremely important. Universities offer welfare services, well-being clinics and stress management courses, and you can also seek help through your GP (remember to register with your local practise). It is important to get plenty of sleep, learn how to shut off in the evenings and weekends.

Remember, there are those around you who are going/have gone through similar experiences. Peer support is a vital (although not often spoken about) form of support while doing a PhD, so try and put into place a good support network. Attend School social events, especially those organised for PhD students. And talk to your supervisors, they may be more understanding than you think.

Look out for parts II and III, which include advice on data management, giving presentations, writing up your thesis and planning for your career beyond the PhD, in the October and November issues of Geoscientist.

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Essential tips for a rock-solid geoscience PhD: Part II

In the second of a three-part focus, Melanie J Leng & Anson Mackay advise on how to ensure your PhD experience is a good and productive one.

We previously gave tips on how to choose the right project and supervisor, as well as how to manage the student-supervisor relationship and your time. Here we offer advice on the practical side of doing PhD research.

Training

Most geoscience PhD students have access to training courses and some will be compulsory. In the UK, Doctoral Training Partnerships collates training courses across universities to offer a wider choice and to facilitate cooperation and sharing of good practise. Funding bodies, such as NERC also offer training. You should take the initiative, know what courses are available and determine with your supervisor which are essential.

Organising your data

Train yourself to be competent in a data analysis package. R—free software for statistical computing and graphics—is probably essential, and will augment what you can do with your data. Coding for many geoscientists is vital, and increasingly code is required for peer-review, too. Your coding should be clean and really well annotated, so that you can understand what you have done and others can repeat it. Bespoke analytical packages are also important.

To present your data, become an expert in a drawing package. The learning curve with all new software packages is steep, but the view from the top is worth it. Gantt charts are useful to illustrate the start and finish dates of different elements of your work (at experiment to thesis scale); to break down your work into chapter/thesis sections (good for supervisory meetings); and to show the dependency of activities. Slack is a great way to interact with key members of your

project team.

During your PhD you will read a lot. Even for experienced researchers, there is too much information out there. Be organised about your reading. It is critical to keep on top of references to read and cite—there are software packages to help with this. Keep PDF versions of key papers and annotate them as you go.

Backup your files on the university server (there will be a university policy), as well as other places, such as Dropbox and Google docs (and periodically update an external hard drive in case you lose internet access). Some data-storage platforms may not be particularly secure and specific restrictions might apply.

Presentations

Dissemination of knowledge is an essential part of the PhD process and you should try to give many presentations. This can be terrifying at first, so prepare well. Start local, presenting to your peers and supervisors, and work up, aiming for a big international conference. At conferences, presentations are given as talks or posters. Each have their strengths, so try both. Think about potential questions you may get from the audience and prepare a couple of slides to address those. You will likely have a tight travel budget, so discuss a strategy with your supervisor. Perhaps save for a major international conference in your third year (like the European Geosciences Union General Assembly). Many small grants are available for students, through your university or relevant associations and learned societies. Specialist organisation membership is usually cheap for students and you can attend their meetings and training courses.

Many people find public speaking daunting. Book a presenting course at your university and practise, practise, practise. Some people have debilitating stage fright or extreme anxiety. If this is you, seek help through your supervisor, the postgraduate office, and welfare office. There are tricks you can do to lessen the stress. Use presenting packages that allow presenter notes that the audience cannot see, or write out memory aides on small cards. The benefits of presentations are tangible and once accomplished, it feels amazing.

In your final year, consider organising a

conference session with fellow early career researchers. Aim to get a diverse group of speakers together (reflecting especially on gender, ethnicity, stage of career) and consider publishing the session papers in a special journal collection. This will help you understand the publishing process and raise your profile.

Writing

Start early and write often. Your first major pieces will likely be a literature review and an annual report or transfer report (to transfer from MPhil to PhD). These should form the basis of a thesis structure, which you should plan from the start (including what data will go into what chapters, though this may change) and review regularly with your supervisor. Many universities now encourage a thesis composed of papers. Remember that papers are different to chapters, requiring a tighter writing style and having less room for descriptions and discussion. You'll also need all co-authors to consent on the content.

When writing papers, agree in advance what data you will include and who you need to co-author with. This can be tricky if you are part of a large multi-(inter)national project where data are owned by different people and may be ready for publication at different times. It is important to be clear about expectations of who will do what early on in the paper development.

Discuss with your co-authors which journal to submit to. Journals have different audiences and while impact factors are commonly looked at, by themselves they are not a measure of the quality of a journal or the papers they contain. You may wish to make your paper open access (OA), so that anyone can read your research, not just those who have access to personal or institutional subscriptions. Many subscription journals offer to make individual papers OA for a fee (article processing charge, or APC). Alternatively, there are a growing number of OA-only journals, where costs for article production and publication are borne by people paying an APC ('gold' open access). These can be very expensive, but such fees are usually dealt with by institutions, who reach agreements with funders to cover the

costs of publishing (for example, for NERC-funded PhD studentships, where the gold route maybe stipulated).

Alternatively, green OA allows you to deposit, for free, the final manuscript (after peer-review but before journal formatting) into an electronic repository (e.g. most institutions have their own repositories, as do funding bodies such as NERC). But copyright and embargo conditions may exist, and will depend on what contract you signed with the publisher of the journal. A few journals, such as *Volcanica*, are now appearing that offer diamond OA. Here papers are free to publish and to read, and the costs are covered by external investment. Finally, most journals now allow you to upload your draft manuscripts into a preprint repository such as EarthArXiv, where earlier versions of your work are free to download and be commented upon. Be aware that the field of publishing is rapidly changing, and you should keep informed about recent developments in Open Science.

We highly recommend, and your funding body may insist, that data be submitted to a data repository such as Pangaea, or NOAA. Make sure that as you collect and organise your data, metadata are considered carefully too.

Once you start publishing (including conference abstracts with ISBN numbers), set up Google Scholar and ORCID accounts (which will update automatically) for maximum outreach. Once a paper is out, consider blogging about it (for the non-specialist) or recording a video introduction (and link these activities to your social media). Many academics have their own social media profiles, such as ResearchGate or Academia. These networks can be really useful to connect with other scientists, but restrictions still exist on what papers can be uploaded.

If you are aiming for an academic position (a post-doc, fellowship, teaching fellow or lecturing position), you might want to undertake a thesis “by papers” and to therefore organise your research around a series of projects or experiments that can be published independently. Some universities

require a traditional thesis, so you might have write your papers and then convert them into monograph-style chapters. It is easier to convert papers into chapters than vice versa, plus you will get more input and advice from co-authors on a paper than you would for your singled-authored thesis chapter.

If your institution allows a thesis by papers, the pros are: publications that greatly enhance your CV and greater input from co-authors in writing the papers. The downsides are: papers can be much harder to write than thesis chapters and will require more time; there is less room for speculation; negative results often do not make into a journal paper, whereas in a thesis chapter you can explore experiments that did and didn’t work; you are at the whim of co-authors and their timetables; the more co-authors the more complex the writing (you have to satisfy them all). In the

geosciences, multi-authored papers are the norm.

Finally, social media is a great way to practise writing, from 280-character tweets to longer blog posts. But we’ll cover that in more detail in part III.

Look out for part III, which includes advice on outreach and how to plan for your career beyond the PhD, in the November issue of Geoscientist.

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Essential tips for a rock-solid geoscience PhD: Part III

In the last part of this three-part focus, Melanie J Leng & Anson Mackay give some final advice

We've previously explained how important it is to carefully choose your PhD project and supervisor, to manage your time and relationships, and given more detailed advice on the practical side of doing a PhD. To finish, we'll cover social media, CVs and some guidance on what to do if a PhD isn't, after all, for you.

Social media

Join up! From day one start to build your online presence (there will be one anyway, so create your own). If using Facebook decide whether it's private (family and friends), work, or a mix. If a mix, bear in mind that posts can be shared, and people may be checking you out. Microblogging and photo/video-sharing platforms, such as Twitter and Instagram, are popular with geoscientists for sharing moments in the field or lab and seeing what other geoscientists are doing. Searchable hashtags (#) are a great way of getting involved with many different communities, ideas and campaigns. Twitter and Instagram are open for all to access unless you lock down your account. If your university personal profile pages are brief then consider using freeware such as WordPress or About.me to create your own personal profile. Keep it up to date with conferences, papers, blogs, social media, contact information, and plenty of action photos.

Blogs are a great way to practise writing short (400-800 words) "stories" on things you have been up to, or fancy talking about. Use lots of interesting photos. Most universities have blog sites for staff and students to contribute to, else create your own using freeware or your website. Video is increasingly popular. Short, one-to-two

minute clips shot on a smart phone can be effective for showing others what you do.

Social media can help build your CV by improving your network outside of your institution and internationally as well; if done well, it will help you stand out from the crowd. But balance your time spent on social media with other forms of writing. Platforms such as Twitter are great for finding out about the latest developments in your field, from a professional, scientific level, to more personal issues related to workloads and stress. But social media has downsides, too, and it is good to recognise these early on to limit the detrimental impacts. Read up on tips for getting the most out of a platform, as well as codes of conduct (held by universities) one should follow.

Curriculum Vitae

There is no one-size-fits-all solution for the perfect CV, but it should always be clearly formatted and short enough to be scanned quickly—and most importantly—tailored to the role you're applying for. Many websites offer advice on writing CVs, but take care to keep it relevant and academic. And keep it up-to-date because you may need it for various purposes; if you apply to be on a committee or panel, for example, and eventually towards the end of your PhD when you will apply for future roles.

CVs should never be completely formulaic, but they should always contain: personal details (name, email, contact phone number and address, social media handles); personal statement (this helps you to stand out from the crowd by explaining who you are, what you're offering and what you're looking for); education (dates, the type of qualification and/or the grade

you achieved); publications (published conference abstracts, papers, preprints, blogs); work experience (with the most recent first); achievements (explain how your previous experience has given you the skills needed to make you a suitable candidate for the position you are applying for); any relevant prizes or scholarships, hobbies and interests that demonstrate your skills and provide interview talking points.

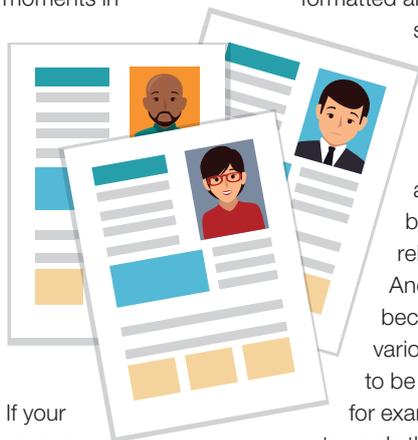
Get involved

Learn to say yes! Grab opportunities as they arise; everyone loves positivity and you will demonstrate energy and teamwork. Apply for positions of responsibility when they arise; early career representatives are often sought. Such positions can provide great experience to find out how learned societies work, and give you opportunities to influence what and how decisions are made.

Learn to say no! As important, is knowing when not to say "yes" all the time, especially if it's a yes for the wrong reasons, or you are just simply over-committed. Saying yes should be an opportunity—not just a request from others. If you are not used to relying on intuition, then think about how a request makes you feel. Knowing when to say no is important for developing healthy, balanced relationships with colleagues. Remember that when you say "no" to things you don't want to do, it frees your time to focus on the pursuits that you really want to do and can be liberating. Never give an immediate answer—think over the request for a day or so and use friends as sounding boards.

What if it all goes wrong?

If for whatever reason PhD research turns out not to be for you, there is often an option to "press pause". That is, you can interrupt your PhD with a break, which might eventually result in withdrawing from your PhD altogether, writing up an MSc or MPhil instead, or transferring to a different PhD project or supervisor. The main thing is to talk



to your supervisors, your postgraduate tutor, your Head of School, and welfare services within the university. Universities have careers services that can advise on the options and possibilities open to you, and any potential implications, as well as appropriate timings and time-limits of interruptions. Universities have forms to complete and approvals to seek, so follow the procedure. If you are an international student, on a Tier 4 visa for example, contact your graduate tutor immediately. They will be able to guide you on who to talk to within your university so that you do not break any visa rules.

In summary

Our advice given in this three-part series is not exhaustive, but it comes from many years of personal experiences. Remember that you have some choice when deciding on a PhD supervisor, take

care to build professional relationships and manage your interactions and expectations. Presentations, writing and social media are significant parts to your PhD that must be tackled head-on. Training and building a CV are vital to enhance your further employment prospects. We briefly touched on critical care, which is all too important these days. Learning to say “no”, as well as “yes”, is essential.

There are many things to consider when embarking on PhD research, but the experience will increase your confidence, communication and management skills, and improve your abilities to understand and solve problems. Enjoy your PhD. It may be tough at times, but it will be an amazing experience. When you pass your viva, be proud of this major achievement and call yourself doctor—you earned it.

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