Succeeding in graduate school and beyond

Graduate school can open many opportunities for continuing to work for the rest of your career in a field that you truly enjoy, but the competition is intense. In any one year, there will only be a handful of positions at research intensive or research and teaching institutions that fit your area of expertise. Also, remember that you will be competing against other graduate students, postdocs, and even professors looking to switch positions. Getting a postdoctoral position can be just as tough and may take even more initiative than applying for faculty positions. The work habits that you develop in graduate school and the quality and originality of your research will go a long way to determining your future success.

Below is a list of recommendations for not just getting through graduate school, but for thriving during the process and succeeding after graduation. Although sticking to these guidelines will not guarantee success, being lazy or unconcerned about your progress will make it unlikely that you will get the job you really want. The suggestions listed below come from the experiences of biologists from universities all over North America. Although the advice is mainly based on getting a job at a college or university, these suggestions apply equally to getting a governmental or NGO position. Read this document carefully. There is a lot of information in it and a second reading may provide additional insights.

Take control of your graduate school experience – you are responsible for your own career in graduate school and beyond

Your days as an undergraduate, where advisors are there to make sure you meet every deadline and take all the right classes, are gone. It is your responsibility to make sure you schedule your classes, fill out the right forms, meet all requirements, and schedule your committee meetings. Your advisor will be there to help you, but don't expect them to micromanage your graduate career. You should be telling them what you want to do. *Never* make your advisor chase you down to schedule your meetings or to make sure you meet the requirements for advancing to candidacy or timely graduation. The same goes for manuscripts, grant proposals, and thesis chapters. You should be pushing harder to get them submitted and finished than your advisor. Discuss your medium- and long-term goals with your advisor. You will get valuable advice on whether they are realistic and suggestions for how to meet them.

Make a long-term plan as well as short-term goals right away

From very early in your career, you should be setting goals for your day, week, month, year, and degree. Of course you are likely to deviate from this plan for the longer-term goals because of the vagaries of your program of study (e.g. problems with fieldwork, unexpected personal issues, etc), but do everything you can *not* to do so. Making excuses is easy, but when you have a plan your goal should be to overcome challenges to stay on target. You should make goals for when you want to reach milestones of your degree (candidacy, defense, etc), when you want papers to be submitted (and which ones they will be), and when/what scientific meetings you will attend.

Part of making a plan is knowing where you want to go after graduate school. As you plan, you should always keep in mind what you want to do when you are done with graduate school. How you go about developing your research will be determined at least partially by what you want to do when you are finished. You should never finish up and say to yourself "what now?" You should know this well in advance – a good rule of thumb is to start thinking about and looking into postdoctoral positions or jobs a year to a year and a half before you finish. If you want a position at a major research university, be prepared to be a postdoc for several years. Most positions now require postdoctoral experience and selection committees want to see that you are capable of keeping your own work going and developing a lab that will be answering important questions for years to come. There are not many postdoctoral positions out there and usually you will need to contact a potential postdoctoral supervisor and work on a proposal together. *Plan on having to do most of the work for such a proposal yourself.*

Work hard and be disciplined (or What's a week in the life of a graduate student? . . . or Getting a PhD is your LIFE – not just a job)

It is easy when you think of doing a multi-year degree that taking an hour or a week off here and there or working on a side project (or even just assisting with a project another student is working on) won't be a big deal. This is a fast way to end up stuck working on your degree for years longer than you anticipated, and to have your work not reach the level it could. You don't need to be selfish, but you absolutely need to know what you have, what you need to do, and how you are going to do it (with a time-buffer built in). Think of how many papers you could have read or how much writing could be done in a day that you spend doing something else. It adds up very quickly. Also, you will find that long stretches of working hard are the best for coming up with novel ideas or synthesizing literature relevant to your research. Working intermittently just does not work as well.

You should enjoy your work (or why would you be doing this?), so working hard should not be a problem. Perhaps the biggest difference between graduate students (and professors) who are successful and those who are not is their work ethic and ability to stick to a plan. As a graduate student, you should be working harder than most professors. That means longer hours, longer weeks, and fewer vacations. The most successful students work because they love it and are dying to get into the field, to the lab, or to a computer to analyze data and write-up papers. Successful students also never make excuses to themselves (or others) – it becomes a necessity to often put off other activities in order to read important papers, analyze data, conduct experiments or fieldwork, or write manuscripts. Writing is especially easy to put off, but don't fall into that trap! Instead, set aside a block of time to write and assume that putting together a good proposal or manuscript/chapter will take far longer than you expect!

Do not treat graduate school as a typical job with a 40 hour work week. Being successful in graduate school requires many more hours – often it may be 70 hour weeks or more. Most successful academics and graduate students want to be working on their research whenever they have time and will spend most of their waking hours thinking about and doing their research. Don't think that just putting in

hours, however, is enough. Keep your weeks productive by setting goals, and working toward them in an organized and efficient manner.

Get to know your lab and their research quickly and thoroughly

In graduate school, you should be learning an incredible amount from other graduate students as well as your advisor. Most of us end up learning far more from interacting with other graduate students than our advisor because we have so much more time with them around the university and outside of it. When you enter a lab, read all of the recent papers by your advisor and students in your lab to know what is going on. Talk to your lab mates often about their research and your research. When you have questions about techniques or literature talk to other students and postdocs. This type of interaction will help you immeasurably in terms of mastering the state of your discipline and generating your own novel ideas. While you are likely to learn the most from other graduate students in your lab, do not limit yourself - interact with students outside of your lab. Talk *science* with them.

Learn to be critical (but not mean)

A major transition that needs to occur very early in your graduate student career is from simply reading papers (or hearing talks) and accepting them at face value to critically analyzing their methods and their conclusions. There are plenty of papers out there that make claims that simply are not backed up by the data. You must be able to identify these. Learn to deconstruct papers to assess 1) if the introduction really frames the question appropriately and accurately reflects the state of the field, 2) if the methods used can really answer the stated questions, 3) if the methods and analyses are appropriate, 4) if the results support claims in the discussion, and 5) what gaps remain in our knowledge of the field. Just about every paper has some weaknesses. The next step after mastering the critique is to determine if those weaknesses are bad enough to invalidate the conclusions regarding the biological phenomenon being described.

Always be constructively critical of proposals and manuscripts of other graduate students. It is far better to get a critical appraisal from a peer than an advisor, committee member, or reviewers. When making suggestions or identifying weaknesses, be very careful about how you phrase them so as not to antagonize or overly upset your fellow student. The art of being constructively critical (and nice about it) will be very important later in your career when you must review papers. Don't be the person who makes an arrogant comment about a manuscript that is wrong! Also, when possible, don't just identify a weakness, but detail specific ways that the weakness can be corrected.

Finally, the most important person for you to be critical of is yourself. Be your own worst critic. Always think about what the weaknesses are in your proposals or manuscripts. It is far better to catch possible problems early on, and you are the first person that has the opportunity to do so.

Impress those who you need to support you in a future job search – get to know your committee members and make sure your relationships with them are *positive*

You will always need three or four letters for a job application and they will need to be *great* (not just "s/he did a fine job"). That means you need your advisor and a couple of your committee members to know your work well, like your work, and be impressed with you personally. Also, interacting with your committee outside meetings will only improve the quality of your work. In order to have productive interactions with your committee, always have a clear purpose for a meeting other than "I have to have one this year." Know what you want to get out of the meeting and make it clear to your committee right away. Never be lax or dismissive of the importance of a committee meeting – your committee has a lot to do and you never want them to feel like you are wasting their time or don't care what they think. Once the meeting is over, follow up with the issues raised in the meeting and keep your committee informed of your progress. Often a summary page of what suggestions were made and what you are going to do to address them is very much appreciated and might get your committee to give you even more helpful feedback.

Never give your advisor or committee a poorly-written manuscript and never give your advisor or committee a draft when a final version is due immediately

Every time you give somebody something to read you are making an impression. Even if you say it is a rough draft, you will be judged based on what you have produced. So, *never give your advisor an incomplete draft of a manuscript or proposal.* Also, never give your advisor a first (or even second) draft. Use your peers – especially the ones who are most critical (a "this is great" doesn't help at all). If you think your draft could be better – make it better before giving it to your advisor. This *does not* mean you should not get help from your advisor during the writing process. Talk about ideas, go over statistical analyses and figures, and discuss an outline of your manuscript, chapter or proposal. Interacting frequently with your advisor will enhance the quality of what you produce and help you get it done faster. *Never think to yourself that your advisor will "help find the story" or "clean up the writing" of your drafts.* It is your job to do the bulk of that work. One thing that helps in the writing process is starting with a very detailed outline. This will help ensure that your ideas flow well and will ultimately help you get finished faster.

Never send out a chapter, draft manuscript, or proposal draft to your committee without first getting the ok from your supervisor. Don't assume this will happen quickly. Many an advisor has been frustrated when a student takes months to put something together, has interacted minimally about its content, thinks it is fine, assumes that their draft will need little work, and that it will be read and commented on instantly. Plan ahead – know your deadlines and get drafts submitted at least a month ahead of time. This doesn't mean there will not be quick turnaround situations, but keep them to a minimum and only when necessary (procrastination does not qualify as "when necessary").

Just like your advisor, your committee needs time to look at your drafts. If you don't give them time, you give the impression that you procrastinate and you will not get good (or detailed) comments back.

Never send something out and say "sorry this is late, but I was busy." You can bet your committee and advisor are extremely busy and you will not garner any sympathy. As a rule of thumb, get your "final" chapters to your committee three months before you plan to defend – you need time to make major changes if they are asked of you. Whatever you do, don't give your committee a complete dissertation (that they haven't ever seen) a month before you want to defend. Finally, when submitting chapters to journals, always first solicit comments from all committee members. Even if they not have time to review the manuscript in detail (this often will happen), you want to give them the opportunity to comment as this document as it will eventually become a part of the final dissertation.

Read, read, read (broadly and critically)

Keeping up with the literature is only getting harder with every passing year due to the incredible number of studies. However, it is *critical* that you know both the literature in your field and the wider literature. This means knowing the classic papers and the most recent studies. As a graduate student you have more time to do this than anybody else, so you should *never* go into a meeting with your committee or advisor and not be aware of a key paper. It borders on the inexcusable to not have read well-known key papers that are related to the methods you need to use or your general field when writing a proposal/paper or talking to a colleague or committee member. And it *is* inexcusable not to have a through knowledge of your advisor's publications. You should know the literature better than your committee and advisor and be pushing them. By reading broadly you will also bring new ideas to bear on your research.

Having a thorough understanding of the literature is one of the things you *can* control that will help you get a paper accepted – you can't control the reviewers, the editor, or if the journal has space but you can make sure that a reviewer doesn't say you missed relevant literature! Some tips for getting the most out of the literature:

1. Reading an abstract is not good enough in most cases
2. Don't forget to look for current books in your field
3. Use the literature cited in papers you read to identify important or interesting literature – get the originals and read them instead of counting on the interpretation of a paper that cites them
4. Be sure to look through the table of contents of *many* journals that may have relevant (or even just interesting) articles every month! For key papers, see who they cite and who cites them.
5. Read the abstracts of *all* the papers in new issues of major journals in your field get a sense of what is important currently in the field – read many of the papers and absorb the thinking style of the investigators and the writing style (including how ideas are presented and work is framed).
6. Just because you can't get a pdf off the internet doesn't mean you can ignore a paper. Be sure you read *all* important and relevant papers even if they are hard to get.

Join a major society (or several) and attend meetings – even if you aren't presenting

Going to a national or international meeting of a scientific society is a great idea. Attend as many talks as you can to hear about cutting-edge research in your field (and fields outside your own). Talk to as many people as you can at these conferences about their ideas and yours. But, make sure you know what you are talking about – bad impressions are hard to overcome. Early in your career, try to get people talking about their work and absorb everything you can. When you are at the conference, take notes on all the talks you attend – that will ensure you are really paying attention and will probably result in you coming up with new ways to approach your own research. By paying close attention to the myriad ways academics present their research, you'll acquire more effective public speaking skills and learn to avoid oratorical pitfalls.

Even if you are not yet presenting your own research, attending a major meeting is a very good idea. For most of us, we had to dig deep into our own pockets to attend meetings early in our careers, but it more than paid off professionally. There are plenty of ways to keep costs down, including piling many students into rooms or staying at a hostel rather than the conference hotel. If you are presenting your research, your advisor may be able to pay for your travel. Also, the GSA or department often have funds to support travel when you present a paper.

If you are presenting your research, *be aware that you are always being judged – giving a talk at a major meeting is a tremendous opportunity – but also a potential trap.* A single talk can make or break your reputation. A great talk at a national/international meeting will be remembered and can get you a job offer down the line. That means that your reputation can be made in a single moment, but if you give a bad talk people will remember it too. You can lose your reputation as quickly as you make it so *NEVER GIVE A POORLY PREPARED TALK*. Along with this, never give a talk at a major meeting before it is ready. Make sure you are ready to make an impact!

Carefully design your research – always think of what it will take to get your work accepted by top-tier journals

Being creative is one of the most important aspects of being a successful scientist. This starts with developing interesting questions and creating approaches to answering them and presenting your results in both oral and written format. Every step of the research process is important, and if you aren't thinking about how you can get your work into the best journals every step of the way, it is likely that it won't get in. Always try to think of what the nastiest reviewer is likely to say about your work and determine how to overcome that criticism. Some important things to keep in mind are:

1. *Strive to lead your field – be independent, be original, and take ownership of your project*

Most universities are looking for people at the top of their field. If you are doing a PhD, you should strive to be the leader of your field. Try not to do the same thing your advisor does. Find a way to make the work your own and to add your own ideas. With the time you have to devote to your project, you

should soon be pushing your advisor, including pointing out the new important literature and developing new ideas independently that you can share and develop with your fellow students and advisor. You should not be waiting for your advisor to send you papers or give you ideas.

2. *The answer to the question "what do you work on?" is not a taxon or "interactions between x and y"*

Try to identify a project that addresses a fundamental biological question or takes a novel approach to elucidating biological processes. Even if your work is relatively taxa-based (and we wouldn't know much about more than a handful of species if there were not good reasons to study particular taxa beyond them being the perfect model system to test theory), there are good general questions that can be addressed. Also, get to know more than the species or general taxa you are studying. The biggest leaps within taxonomically-based research often come from people employing methods or insights derived from other taxonomic groups or taking a comparative approach. Remember that you want your papers to be cited in the literature beyond your own. If you work on owls, you want your work to be cited by more than just other owl biologists!

3. *Never justify your work because something "is poorly known."*

Lots of things are poorly known –justify why your poorly known subject is more important than other poorly-known topics.

4. *Develop a good research question that can be addressed over the time period of your PhD or Master's research.*

Make sure that the question you are addressing is of broad interest. Especially for PhD research, you need to be targeting the best journals and that requires a good question and explicit hypotheses or predictions being tested. Also think about building a "coherent body of work," which is what search committees are looking for. However, remember that you need to be able to answer these questions over the course of your degree. Don't bite off more than you can chew!

5. *Don't spin your wheels in the field or the lab – make a plan, execute the plan, but be ready for triage*

Before you even start your work, you need to know what data you need, what your approximate sample sizes will need to be, and how you will gather your data in the time you have. Part of making a good field plan is having an idea how you will analyze your data. This means getting a good background in statistics. Take classes, read papers, and talk to other students and your advisor. You will be the one who has to analyze your data, so you need to take the lead in acquiring the statistical tools you will require. Another important skill is developing good data sheets and data collection methods. Having good datasheets that ensure you collect all the data you could possibly need is critical. Bad data sheets and bad sample labeling protocols can lead to frustration and compromised projects. Before going to the field, make ranked lists of what is most important and what is bonus information or constitutes a side-project. This is important because there are always more ideas than time and unexpected

circumstances (equipment breakdowns, bad weather) are common. You will have to know what data you can live without and what you can't. To be able to do this you always need to be thinking about the *questions* you are trying to address rather than the data you initially planned to gather. Always ask yourself "why am I doing this?"

6. *Don't wait until you are "finished" to start analyzing your data*

As soon as you have enough data to do preliminary analyses, get on it. That way you will be able to tell if your samples are large enough or if you need to gather more data. There are few things more disheartening than thinking you are done only to have your analyses tell you otherwise.

7. *Check and recheck your data. Then do it again.*

This is a no-brainer. If you have assistants helping you with fieldwork or data entry be especially careful to check and re-check their work and don't count on them to get it right (never delegate critical tasks or ones that you can't check). That means checking original data sheets against data entered in the computer. Keeping a field journal or lab notebook also is a *very* good idea. It can help you identify possible errors in your data!

8. *Backup your data and your chapters/manuscripts in multiple locations.*

Bad things happen. The only way to ensure you do not lose irreplaceable data or hundreds (or thousands) of hours of work is to backup your data and work often and keep copies in separate places.

Apply for every grant, fellowship, or scholarship you can

Getting a job or interview often comes down to whether a selection committee thinks you will be able to fund your work or that of an entire lab. Establishing a well-financed research track record early in your career is important. Be creative in finding your own funding for your work even if your supervisor can cover it. Think of how you can get sponsorships or donations. With traditional sources of funding becoming more competitive and smaller, successful scientists will more and more have to look elsewhere to support projects.

Publish, publish, publish (or perish)

Your future success and ability to secure a job, especially in academia, will be based largely on your publication record. Therefore, you must work to publish as many high-quality papers as possible. Do not, however, strive for perfection at the cost of significant time. You must learn to balance the time invested with the quality of the paper you submit. Here are some bits of advice:

1. *Don't work on many papers at once – get the one closest to being finished submitted as fast as you can.*

Papers tend to get written faster, and are better quality, when they are worked on exclusively. If you try to jump back and forth among several chapters or manuscripts, they will all take longer to get finished. No matter how excited you are to move onto the next manuscript, finish the one that is closest to submission first!

2. *Think of how your thesis can be published sequentially so you don't have to write up and submit several papers all at once.*

You need to have several papers at least 'in press' (not just 'submitted') to be competitive for post-docs and jobs when you complete your degree. Otherwise, you'll have "outrun" your papers and may have to wait for them to come out before you can move on with your career. Also, manuscripts tend to lie dormant and unsubmitted once you have graduated and have another job to do. Don't fall into this potential trap.

3. *Don't waste time writing too many notes or papers for obscure low-impact journals*

Search committees don't just count the number of papers – they look at the role you played in the publication and the *quality* of the journal. One paper in a journal like *Ecology*, *Evolution*, or better, will count for much more than a bunch of notes in obscure journals. Publications in low-impact journals (less than 1.0) almost don't count in the minds of some people who will be reviewing your applications. Work toward building a solid "body" of publications in good journals. Publishing natural history details often is important to building toward your higher-profile papers, but keep such publications to a minimum and get them out quickly!

4. *Know what you need to do to be competitive for a job*

Getting a job at a major research university will require a substantial publication record. Without ten publications, most of them first-authored, you probably won't get an interview. Things aren't much better at competitive liberal arts schools. For somebody applying straight out of their PhD, at least six papers - with three of them first-authored – probably will be needed to get an interview. If you are applying from a postdoctoral position, about ten papers will be expected. For a research intensive university, the bar is even higher. Remember when you are deciding how much to invest in side projects that less weight will be given to papers where you are just one of a long list of secondary authors. It may be helpful to talk to recently hired professors about their background to keep up with what it takes to get a position.

Become known in your field

If your goal is to eventually go into academia where you will have your own research program and graduate students it is important that people in the field know you and your research. Accomplishing

this involves much of the advice in other sections (do meaningful research, publish, go to conferences), but it also means trying to distinguish yourself from your advisor. Try to develop your own projects or push your project beyond the expertise of your advisor and then disseminate it through publications and conferences.

Some other bits of advice

1. *Remember you are owed nothing (and appreciate the help you get)!*

Your advisor and committee will be there to help you, but you are responsible for your success in graduate school. Don't sit back and wait for things to happen – get out there and make them happen yourself. Also, keep in mind that your advisor is probably working very hard to make sure that you are fully funded in salary and research money. However, resources are not unlimited and advisors usually are trying to juggle the needs of multiple students so you may not get everything you want. That means that sometimes you will have to decide whether you want to use your own resources or wait and hope that resources will materialize. Also, always be aware of how much your advisor is doing for you behind the scenes. The best advisors are working incredibly hard to help you succeed and are trying to get resources and remove unnecessary obstacles to your success. As a student you rarely see this, but you should be aware of it and not take it for granted. Asking your advisor to do menial work for you or taking a blasé attitude towards research setbacks, equipment use and abuse, or the use of research funding is not a good way to build a positive relationship with your advisor.

Don't complain about staff. Most staff are present to help faculty or run facilities. As a graduate student, you are responsible for your own work. That includes all of the work that secretaries, techs, and managers do for faculty. If you get help from staff, consider it a bonus. Never rely on staff to do your work – it is ultimately your responsibility.

2. *Develop a thick skin, be persistent, and try to stay off the rollercoaster*

Nobody likes to be rejected, but in this line of work it happens all the time. Committees (or advisors) can be harsher than they mean to be. Manuscripts get rejected for good reasons, no reason, and everything in between. Grant and fellowship applications are declined, and so are job applications. It is very difficult to not let this get you down, especially if you go through a bad streak. Many very successful scientists have been on the verge of throwing in the towel because of the frustrations of rejections. However, to succeed you have to be able to overcome these setbacks and come back stronger. Often, a rejected manuscript can turn into something better and sometimes even end up in a better journal. The same thing goes with grant proposals – try to take the constructive comments and use them to get better. In time, you should be able to stop losing sleep over these road bumps and remain fairly positive. Of course, that is not to say you shouldn't care about the outcome of your work – the most successful scientists care deeply about the work and how it is perceived by their field. It is also important not to overblow your successes. Enjoy them, but academia can be a "what have you done for me lately" field, so use the highs to reach your next goal and keep striving to accomplish more.

3. *Be a positive person – quickly strive to fix things that drag you down*

If you can be a positive person, you will find that you will get more help from everybody around you. It is easy to succumb to graduate student angst about not being paid enough, not getting enough attention, and studies not going as well as you had hoped. This type of frustration, which can set up a vicious cycle whereby discontent begets inferior work and so forth, only gets worse when a bunch of people start complaining together and therefore must be avoided. Focus instead on what is going right and try to find ways to fix things that are not. Everybody can find things about their situation that are good and things that are bad. Simply dwelling on the negative and not doing anything about it will only hurt you!