Rules for Starting Graduate School Successfully

You're not an undergraduate any more, so don't act like one!

1) Gone are the days of sitting in a classroom like a baby bird with your mouth open, waiting for the professors' regurgitation of "facts" to be dropped in. You will need to figure things out for yourself. Although you can ask questions, you will be expected to figure out, *on your own*, significantly more than what you will be told. It will be important to read a ton yourself, identify primary literature (not just Google and Wikipedia!) in your area, figure out within published papers what's real vs. BS or hype, and generally identify, think about, and work through problems rather than waiting for someone to show you how to do X or Y.

2) Also gone are the days of getting up at 10am and having your nights and weekends free to do whatever you want. One of the best ways to turn off a rotation mentor is to ask, "How many hours do I *have* to be at work per week?" What he/ she will hear instead is, "I am not here because I'm passionate about science, and I want to snake by on the minimum possible." Your mission is to complete as much research as possible. There's a positive correlation between time at the bench and getting more research done. That said, you can't be at work every second of every day, and people sometimes work better when they have an "outlet" that's outside of work. Still, expect to be doing *some* type of work (including reading papers- *really* reading them, not having them on your lap while you watch American Idol) well over 40-hours per week, and plan to be at the bench most of that time.

3) Show real initiative in thinking about science. Keep a notebook of "crazy project ideas", and write down notes in it. Look up papers on the topic you're researching <u>well beyond</u> those pointed out to you. Annotate papers as you read them with comments. Think about other experiments that *could* be done, and talk about these ideas with others in the lab and the PI. Are there alternative approaches to the experiments you are doing, and what are the pros and cons? Take notes at seminars, and discuss the findings with others. What could they have done better (scientifically)? Is there anything you can learn from their studies?

4) *Think about why you're here.* You should be here because you love science, love figuring things out, and generally love what you're doing. This is a career track, not a part-time job. If you don't act and feel passionate about it, then you'll have a very hard time achieving more than mediocrity in it. Find that passion and excitement in yourself for your work: both your research and your reading.

5) Hold a high (but reasonable) standard of responsibility for yourself. Typical bad undergrad will have excuses for why X or Y couldn't get done at all or in time. Star graduate student will instead have contingency plans. Don't wait until the last second for getting assignments done (or even "printed"). Plan ahead. And think seriously- excuses like, "I didn't finish and couldn't call or e-mail because I was out of town" are lame in this decade of cell phones, internet cafes, home cable modems, etc.

What to do/ expect in your first year

2 RULES:

Read a lot, in a wide variety of subdisciplines within you discipline of interest (e.g., ecology, evolution, biochemistry, physiology, etc.). DO NOT become a "specialist" on day 1 and ignore all papers that are not on salamander mating displays. Read papers on different organisms (yes, even different kingdoms), different questions, different approaches, etc. Regardless of what you think or what you've done previously, you are not ready to specialize that much yet.

Meet people. Show up for department seminars and talk to people (both faculty and students). Get at least 4 faculty to know who you are beyond a face in a classroom. Go to BioGrads activities. Introduce yourself to the office staff, to folks in the labs next to the one in which you're working, etc. It'll be important to talk with the pre-existing graduate students about various issues (e.g., what classes to take) that come up, so it's especially important to get to know them.

CLASSES:

Some faculty will not know what classes are good or bad, so get multiple opinions and opinions from both faculty and students who've taken the courses. Talk to the professor who teaches the classes you'd like to take, and get a syllabus.

Take a statistics class of some sort (unless you've already had a good class in it). You'll always think you can get away without it, and you'll be wrong.

PICK AN ADVISOR:

While some of you will do "rotations" in various labs, others may join a lab group directly. In deciding on a lab/ advisor, talk with the advisor's former students who have graduated and gone on elsewhere. Their input *may* be more fair than the current students, who may have had an especially good/ bad week and have their stated opinion based more on that week than overall. That said, with <u>any</u> feedback you get, keep in mind that people's interactions and expectations are different: among those within a lab, it is not unusual for one student to be consistently very happy while another is miserable.

Do your best to pick someone with whom you feel you can work with, communicate with, and interact with closely over the next 5-7 years and beyond (you'll need letters for many years thereafter). It's better to switch advisors in your first year than after you've been there for several years, so now's the time to evaluate this relationship VERY closely. However, you should voice concerns directly, too- don't just turn around and leave one day. Treat your potential advisor with the same respect you want to be treated, and if you're not getting what you want, tell him/ her directly. It's always better to hear it directly than from a third person as gossip.

Picking a Lab / Advisor

Some people come to graduate school specifically to work in a particular laboratory, while others come and rotate among several labs, choosing at the end of the rotations where they'd like to be housed. One thing to keep in mind: even if you came to work in a particular laboratory, do evaluate when you first begin whether you feel it is a good match. It's always better to jump ship early than to do so halfway through a PhD!

1) Unequivocally, the #1 question has to be this one: **Are you sufficiently excited about the type of research being conducted in this laboratory that you can see yourself diving into it for the next several years?** If you are hesitant or only lukewarm on the research after a few months, that could be a grave warning sign. The value of your PhD will be defined by your research success, and you cannot be successful if you're not excited about what you're doing.

2) **Are you and the advisor a good match in terms of working together?** If you're someone who wants a lot of attention/ structure, is your potential advisor accessible/ responsive? There's a lot of variance in what students want/ need, and there's a lot of variance in advisor behavior, so try to find someone with whom you'd be able to have a successful scientific partnership for the next 5 years. Do you get (and want) weekly individual meetings? Do you get (and want) timely feedback either on your progress or on manuscripts/ proposals/ etc.? Do you feel your advisor makes unreasonable demands of you, and if so, what is his/ her response if you indicate that sentiment?

3) **What has been the success of previous graduate students in this laboratory?** Have previous students in this lab gone on to win awards, get good postdocs or other positions, etc.? Did they publish many and/ or influential studies from their time in graduate school? Obviously, this question is unfair for new faculty, but among faculty that have been around a long time, it's a good thing to consider.

4) **Are the resources for the type of research I want to do available?** Many laboratories undergo periodic lapses in funding or staffing, but a long-term lapse could be symptomatic of a greater concern. Relatedly, how does the advisor handle missing resources- swift attempts to find alternatives or empty promises that are rarely fulfilled?

Advisor / Graduate Student Complaints

Major issue: Advisors and their students generally **fail to communicate** their expectations *a priori*. Students typically blame this completely on the faculty member, without remembering that many faculty members have only mentored a few students in the past, so are perhaps equally inexperienced.

About advisors by students:

1) Failure to communicate
2) Not treated with respect or as a priority (insufficient time)
3) Micromanaging, or lack of feedback on probability of success of proposed work
4) Irresponsibility or inconsistency
5) Overloading of students with too many sidelines
6) Taking favorites
7) Failure to consider timelines for letters/ feedback on proposals/ etc.
8) Insufficient positive feedback or direction
9) Relationship boundaries

About students by advisors (as listed by students, not advisors):

1) Insufficient number of hours spent doing research
2) Too much time devoted to activities besides research
3) Lack of visible forward progress, or failure to communicate progress
4) Too much personal travel
5) Not going to scientific meetings
6) Lack of effort at obtaining funding
7) Requesting comments/feedback/letters at the last second
8) Not reading the primary literature in their area of study
9) Passing off non-work as work (e.g., e-mail in lab, web surfing, chit-chatting, etc.)

The Role of the Advisor

(Excerpt from "Graduate School in Science and Engineering: Tips for Students and Faculty")

The mentor/advisor is one of the most important persons in a graduate student's life. "Why do you need a mentor? You can't graduate without one. That's the bottom line." The advisor will guide your research, provide funds for your materials and equipment, provide (or not provide) your financial support and, generally, will have a great deal of influence on the success of your graduate studies. Selecting a mentor/advisor should not be a "snap" decision...do some research before committing yourself to a laboratory group.

What should your advisor expect from you?

Following this section is a list detailing a number of things you will want your advisor to do for you. However, the relationship between a graduate student and his/her advisor must be mutually beneficial in order to work well. The term "graduate studies" is inaccurate...we should use the term "graduate work." You should consider graduate work your job for the next few years...and you should do your best to prove that it is a job that you can do well! With that in mind, we have developed a list of tips for working with your mentor/advisor:

Let your advisor know that you are serious about completing the degree...**Don't Assume That This Is A Given!** Your advisor may have had students before who really were not dedicated to completing the degree;

Discuss with your advisor what you hope to do with your degree, such as conduct research in a university setting, work in industry, or be a full-time teaching professor;

Be Visible!

Attend seminars sponsored by your department;

Work! Graduate school is the time for working long hours...you don't have to live in the lab, but be sure you're getting the work done, even if it means staying late;

Think of your graduate work as a job. Your advisor is putting time (and money, if you're a graduate student researcher) into training you. Show up at work every day and on many weekends. You don't have to give up your social life but this is not the time to go on road trips every weekend!

Early in your graduate work, begin to build your advisor's trust in you...listen to his/her advice. Sometimes accepting this advice can be painful but, unless you feel it is unethical, malicious, or really off target, take it! If you feel the advice is not in your best interest, confer with another faculty member on your advisory committee.

Confer often with your advisor. It is recommended that, once you start working on your dissertation, two weeks should not pass without conferring with your advisor;

Get to know other graduate students (both new and experienced) and other faculty members in your department. Talk with them frequently at lunch or before/after seminars. Learn how to collaborate...the old saying about friendship holds true - before you can have colleagues, you have to be one.

In general, put your mentor at ease. Let him/her know that you're serious, that you're motivated, and that you're eager to earn a place in both his/her lab and in the national network of researchers in your field.

In General, A "Good" Advisor Should:

Be involved in a research area that you are interested in. DO NOT choose a particular mentor/advisor just because they are "nice!" You must be interested in doing serious work over a long period of time in his/her research area...you should not expect him/her to support you in a new research field. Conversely, if you can tell that the faculty member absolutely rubs you the wrong way and that your personalities will clash, you may wish to reconsider your selection or at least have a discussion with several of his/her graduate students;

Counsel you and direct your research - your mentor should be candid about your progress and should feel free to tell you not only when you're doing things right but also when you're wrong;

Direct your course selection and course load - a good mentor won't let you get in over your head or take a worthless course;

Steer you away from people in the department who will create barriers for you (in courses, collaborative work or sharing equipment, for example);

Offer encouragement;

Assist you in understanding and meeting the milestones and deadlines you have to meet (for example, course work, preliminary exams, proposal preparation, and dissertation);

Give you some research freedom...after working in the laboratory for a while, you should have the opportunity to propose experiments...you should not spend your entire graduate work acting as a laboratory technician to carry out someone else's work;

Provide opportunities for you to participate in annual meetings of professional associations, including opportunities to prepare and staff a posters;

Assist you in learning to prepare research papers for submission to professional journals;

Introduce you to colleagues from other institutions, both when they visit your campus and when you attend annual meetings of research associations;

Make every effort to support his/her graduate students financially;

Establish and encourage absolute intellectual honesty in the laboratory group. You should ask other graduate students whether laboratory discussions are open and free.

Make efforts to establish a "cooperative" laboratory group where:

> a network of cooperative interaction exists within the lab group...this should include postdoctoral fellows, both new and experienced graduate students, technicians;
>
> the mentor encourages students and postdoctoral fellows to continue exploring problems begun in his/her laboratory when they move to a new position;

Make sure that arguments about the interpretation of data or development of theories are kept separate from personal barbs or attacks;

Work to make his/her laboratory a part of the informal national network of laboratories in his/her field...for example, does he/she collaborate with other persons around the country?...does he/she act as a reviewer for grants and research journals?

Expose students to the funding process, including opportunities to draft sections of grant proposals, read grant proposals, and discuss how-to's on working with funders;

View science as fun, challenging and exciting work, but also as a very human endeavor.

SOME MODEST ADVICE FOR GRADUATE STUDENTS

Stephen C. Stearns

Always Prepare for the Worst

Some of the greatest catastrophes in graduate education could have been avoided by a little intelligent foresight. Be cynical. Assume that your proposed research might not work, and that one of your faculty advisors might become unsupportive - or even hostile. Plan for alternatives.

Nobody Cares About You

In fact, some professor care about you and some don't. Most probably do, but all are busy, which means in practice they cannot care about you because they don't have the time. You are on your own, and you had better get used to it. This has a lot of implications. Here are two important ones:

1) You had better decide early on that you are in charge of your program. The degree you get is yours to create. Your major professor can advise you and protect you to a certain extent from bureaucratic and financial demons, but he should not tell you what to do. That is up to you. If you need advice, ask for it: that's his job.

2) If you want to pick somebody's brains you'll have to go to him or her, because they won't be coming to you.

You Must Know Why Your Work is Important

When you first arrive, read and think widely and exhaustively for a year. Assume that everything you read is hogwash until the author managed to convince you that it isn't. If you do not understand something, don't feel bad - it's not your fault, it's the author's. He didn't write clearly enough.

If some authority figure tells you that you aren't accomplishing anything taking courses and you aren't gathering data, tell him what you're up to. If he persists tell him to bug off, because you know what you're doing, dammit.

This is a hard stage to get through because you will feel guilty about not getting on your own research. You will continually be asking yourself, "What and I doing here?" Be patient. This stage is critical to your personal development and to maintaining the flow of new ideas into science. Here you decide what constitutes an important problem. You must arrive at this decision independently for two reasons. First, if someone hands you a problem, you won't feel that it is yours, you won't have that possessiveness that makes you want to work on it, defend it, fight for it, and make it come out beautifully. Secondly, your Ph.D. work will shape your future. It is your choice of a field in which to carry out a life's work. It is also important to the dynamic of science that your entry be well thought out. This is one point where you can start a new area of research. Remember, what sense does it make to start gathering data if you don't know - and I mean really know - why you're doing it?

Psychological Problems are the Biggest Barriers

You must establish a firm psychological stance early in your graduate career to keep from being buffeted by the many demands that will be made on your time. If you don't watch out, the pressures of course work, teaching, language requirements and who know what else will push you around like a large, docile molecule in Brownian motion. Here are a few things to watch out for:

1. The initiation-rite nature of the Ph.D. and it's power to convince you that your value as a person is being judged. No matter how hard you try, you won't be able to avoid this one. No one does. It stems from the open-ended nature of the thesis problem. You have to decide what a "good" thesis is. A thesis can always be made better, which gets you into an infinite regress of possible improvements.

Recognize that you cannot produce a "perfect" thesis. There are going to be flaws in it, as there are in everything. Settle down to make it as good as you can within the limits of time, money, energy, encouragement, and thought at your disposal.

You can alleviate this problem by jumping all the explicit hurdles early in the game. Get all of your course requirements and examinations out of the way as soon as possible. Not only do you thereby clear the decks for your thesis, but you also convince yourself, by successfully jumping each hurdle, that your probably are good enough after all.

2. Nothing elicits dominant behavior like subservient behavior. Expect and demand to be treated like a colleague. The paper requirements are the explicit hurdle you will have to jump, but the implicit hurdle is attaining the status of a colleague. Act like one and you'll be treated like one.

3. Graduate school is only one of the tools that you have at hand for shaping your development. Be prepared to quit for awhile if something better comes up. There are three good reasons to do this.

First, a real opportunity could arise that is more productive and challenging than anything you could do in graduate school and that involves a long enough block of time to justify dropping out. Examples include field work in Africa on a project not directly related to your Ph.D. work, a contract for software development, an opportunity to work as an aide in the nation's capital in the formulation of science policy, or an internship at a major newspaper or magazine as a science journalist.

Secondly, only be keeping this option open can you function with true independence as a graduate student. If you perceive graduate school as your only option, you will be psychologically labile, inclined to get a bit desperate and insecure, and you will not be able to give your best.

Thirdly, if things really are not working out for you, then you are only hurting yourself and denying resources to others by staying in graduate school. There are a lot of interesting things to do in life besides being a scientist, and in some the job market is a lot better. If science is not turning you on, perhaps you should try something else. However, do not go off half-cocked. This is a serious decision. Be sure to talk to fellow graduate students and sympathetic faculty before making up your mind.

Avoid taking Lectures - They're Usually Inefficient

If you already have a good background in your field, then minimize the number of additional courses you take. This recommendation may seem counter-intuitive, but it has a sound basis. Right now, you need to learn how to think for yourself. This requires active engagement, not passive listening and regurgitation.

To learn to think, you need two things: large blocks of time, and as much one-on-one interaction as you can get with someone who thinks more clearly than you do.

Courses just get in the way, and if you are well motivated, then reading and discussion is much more efficient and broadening than lectures. It is often a good idea to get together with a few colleagues, organize a seminar on a subject of interest, and invite a few faculty to take part. They'll probably be delighted. After all, it will be interesting for them, they'll love your initiative - and it will give them credit for teaching a course for which they don't have to do any work. How can you lose?

These comments of course do not apply to courses that teach specific skills: e.g., electron microscopy, histological technique, scuba diving.

Write a Proposal and Get it Criticized

A research proposal serves many functions.

1. By summarizing your year's thinking and reading, it ensures that you have gotten something out of it.

2. It makes it possible for you to defend your independence by providing a concrete demonstration that you used your time well.

3. It literally makes it possible for others to help you. What you have in mind is too complex to be communicated verbally - too subtle, and in too many parts. It must be put down in a well-organized, clearly and concisely written document that can be circulated to a few good minds. Only with a proposal before them can the give you constructive criticism.

4. You need practice writing. We all do.

5. Having located your problem and satisfied yourself that it is important, you will have to convince your colleagues that you are not totally demented and, in fact, deserve support. One way to organize a proposal to accomplish this goal is.

    a. A brief statement of what you propose, couched as a question or hypothesis.

    b. Why it is important scientifically, not why it is important to you personally, and how it fits into the broader scheme of ideas in your field.

    c. A literature review that substantiates (b).

    d. Describe your problem as a series of subproblems that can each be attacked in a series of small steps. Devise experiments, observations or analyses that will permit you to exclude alternatives at each stage. Line them up and start knocking them down. By transforming the big problem into a series of smaller ones, you always know what to do next, you lower the energy threshold to begin work, you identify the part that will take the longest or cause the most problems, and you have available a list of things to do when something doesn't work out.

6. Write down a list of the major problems that could arise and ruin the whole project. Then write down a list of alternatives that you will do if things actually do go wrong.

7. It is not a bad idea to design two or three projects and start them in parallel to see which one has the best practical chance of succeeding. There could be two or three model systems that all seem to have equally good chances on paper of providing appropriate tests for your ideas, but in fact practical problems may exclude some of

them. It is much more efficient to discover this at the start than to design and execute two or three projects in succession after the first fails for practical reasons.

8. Pick a date for the presentation of your thesis and work backwards in constructing a schedule of how you are going to use your time. You can expect a stab or terror at this point. Don't worry - it goes on like this for awhile, then it gradually gets worse.

9. Spend two to three weeks writing the proposal after you've finished your reading, then give it to as many good critics as you can find. Hope that their comments are tough, and respond as constructively as you can.

10. Get at it. You already have the introduction to your thesis written, and you have only been here 12 to 18 months.

Manage Your Advisors

Keep your advisors aware of what you are doing, but do not bother them. Be an interesting presence, not a pest. At least once a year, submit a written progress report 1-2 pages long on your own initiative. They will appreciate it and be impressed.

Anticipate and work to avoid personality problems. If you do not get along with your professors, change advisors early on. Be very careful about choosing your advisors in the first place. Most important is their interest in your interest.

Types of Theses

Never elaborate a baroque excrescence on top of existing but shaky ideas. Go right to the foundations and test the implicit but unexamined assumptions of an important body of work, or lay the foundations for a new research thrust. There are, of course, other types of theses:

1. The classical thesis involves the formulation of a deductive model that makes novel and surprising predictions which you then test objectively and confirm under conditions unfavorable to the hypothesis. Rarely done and highly prized.

2. A critique of the foundations of an important body of research. Again, rare and valuable and a sure winner if properly executed.

3. The purely theoretical thesis. This takes courage, especially in a department loaded with bedrock empiricists, but can be pulled off if you are genuinely good at math and logic.

4. Gather data that someone else can synthesize. This is the worst kind of thesis, but in a pinch it will get you through. To certain kinds of people lots of data, even if they don't test a hypothesis, will always be impressive. At least the results show that you worked hard, a fact with which you can blackmail your committee into giving you the doctorate.

There are really as many kinds of theses as there are graduate students. The four types listed serve as limited cases of the good, the bad and the ugly. Doctoral work is a chance for you to try you had at a number of different research styles and to discover which suits you best: theory, field work, or lab work. Ideally, you will balance all three and become the rare person who can translate the theory for the empiricists and the real world for the theoreticians.

Start Publishing Early

Don't kid yourself. You may have gotten into this game out of love for plants and animals, your curiosity about nature, and your drive to know the truth, but you won't be able to get a job and stay in it unless you publish. You need to publish substantial articles in internationally recognized, referred journals. Without them, you can forget a career in science. This sounds brutal, but there are good reasons for it, and it can be a joyful challenge and fulfillment. Science is shared knowledge. Until the results are effectively communicated, they in effect do not exist. Publishing is part of the job, and until it is done, the work is not complete. You must master the skill of writing clear, concise, well-organized scientific papers. Here are some tips about getting into the publishing game.

1. Co-author a paper with someone who has more experience. Approach a professor who is working on an interesting project and offer your services in return for a junior authorship. He'll appreciate the help and will give you lots of comments on the paper because his name will be on it.

2. Do not expect your first paper to be world-shattering. A lot of eminent people began with a minor piece of work. The amount of information reported in the average scientific paper may be less than you think. Work up to the major journals by publishing one or two short - but competent - papers in less well-recognized journals. You will quickly discover that no matter what the reputation of the journal, all editorial boards defend the quality of their project with jealous pride - and they should!

3. If it is good enough, publish your research proposal as a critical review paper. If it is publishable you've probably chosen the right field to work in.

4. Do not write your thesis as a monograph. Write it as a series of publishable manuscripts, and submit the early enough so that at least one or two chapters of your thesis can be presented as reprints of published articles.

5. Buy and use a copy of Strunk and White's Elements of Style. Read it before you sit down to write your first paper, then read it again at least once a year for the next three or four years. Day's book, How to Write and Publish a Scientific Paper, is also excellent.

6. Get your work reviewed before you submit it to the journal by someone who has the time to criticize your writing as well as your ideas and organization.

Don't Look Down on a Master's Thesis

The only reason not to do a master's is to fulfill the generally false conceit that you're too good for that sort of thing. The master's has a number of advantages.

1. It gives you a natural way of changing schools if you want to. You can use this to broaden your background. Moreover, your ideas on what constitutes an important problem will probably be changing rapidly a this stage of your development. Your knowledge of who is doing what, and where, will be expanding rapidly. If you decide to change universities, this is the best way to do it. You leave behind people satisfied with your performance and in a position to provide well-informed letters of recommendation. You arrive with most of your Ph.D. requirements satisfied.

2. You get much-needed experience in research and writing in a context less threatening than doctoral research. You break yourself in gradually. In research, you learn the size of a soluble problem. People who have done master's work usually have a much easier time with the Ph.D.

3. You get a publication.

4. What's your hurry? If you enter the job market too quickly, you won't be well prepared. Better to go a bit more slowly, build up a substantial background, and present yourself a bit later as a person with more and broader experience.

Postscript

This comment was originally entitled "Cynical aids towards getting a graduate degree, or psychological and practical tools to use in acquiring and maintaining control over your own life." It originated as a handout for the Ecolunch Seminar in the Department of Zoology, University of California, Berkeley, on a Monday in the spring of 1976. Ecolunch was, and is, a Berkeley institution, a forum where graduate students present their work in progress and receive constructive criticism. At the start of the semester, however, no one is ready to talk. This was such a time.

On Friday morning at Museum Coffee, Frank Pitelka, who was in charge of Ecolunch for that semester, asked me to make the presentation on the following Monday. "Asked" is probably a misleading representation of Frank's style that morning. Frank bullied me into it. I had just given a departmental seminar on the Ph.D. work I had done at British Columbia, and did not have much new to say about biology. Frank's style brought out the rebel in me. I agreed on the condition that I had complete freedom to say whatever I wanted to, and that the theme would be advice to graduate students. Frank agreed without apparent qualms. Then I charged upstairs to Ray Huey's office to plot the attack.

I whipped out an outline, Ray responded with a more optimistic and complementary version (see the following Commentary article), and I wrote a draft at white heat that afternoon. We felt like plotters. We were plotters. There were acts of self-definition in the air. On Monday, I recall that I made a pretty aggressive presentation in which, to emphasize how busy faculty members were, I kept looking at my watch. Near the end I glanced at my watch one last time, said I had to rush off to an appointment, left the room suddenly without taking questions, and slammed the door. They waited. I never came back, but Ray took over and presented his alternative view. Ray told me later that Bill Lidicker turned to him and said, "You mean he's not coming back?" I wasn't. Fortunately, they took it well. They were and are a group of real gentlemen.

I mention these things to explain the tone of our pieces. We would not write them that way now, having been professors ourselves for some years. We never intended to publish them, having regarded the presentations as a one-time skit, but our notes were xeroxed and passed around, and eventually they spread around the United States. In the fall of 1986 I got a letter from Pete Morin at Rutgers suggesting that we publish the notes. Its survival for ten years in the graduate student grapevine convinced me that there might actually be a demand for them. I had lost my original, and Pete kindly sent me a copy, which turned to be a nth generation version with marginal notes by a number of different graduate students. On rereading it, I find that I agree with the basic message as much as ever, but that many of the details do not apply outside the context of large American universities.

Ten years later, I have one after-thought.

Publish Regularly, but Not Too Much

The pressure to publish has corroded the quality of journals and the quality of intellectual life. It is far better to have published a few papers of high quality that are widely read, then it is to have published a long string of minor articles that are quickly forgotten. You do have to be realistic. You will need publications to get a post-doc, and you will need more to get a faculty position and then tenure. However, to the extent that you can gather your work together in substantial packages of real quality, you will be doing both yourself and your field a favor.

Most people publish only a few papers that make any difference. Most papers are cited little or not at all. About 10% of the articles published receive 90% of the citations. A paper that is not cited is time and effort wasted. Go for quality, not for quantity. This will take courage and stubbornness, but you won't regret it. If you are publishing one or two carefully considered, substantial papers in good, refereed journals each year, you're doing very well - and you've taken enough time to do the job right.

Acknowledgments

Thanks to Frank Pitelka for providing an opportunity, to Ray Huey for being a co-conspirator and sounding board and for providing a number of the comments presented here, to the various unknown graduate students who kept these ideas in circulation during the last decade, and to Pete Morin for suggesting that we write them for publication.

Some Useful References

Day, R.A. 1983. How to write and publish a scientific paper. Second edition. ISI Press, Philadelphia, Pennsylvania, 181 pp. wise and witty.

Smith, R.V. 1984. Graduate research - a guide for students in the sciences. ISI Press, Philadelphia, Pennsylvania, USA. 182 pp. complete and practical.

Strunk, W., Jr., and E.B. White. 1979. The elements of style. Third Edition. Macmillan, New York, New York, USA. 92 pp. the paradigm of concision.

Stephen C. Stearns

Department of Ecology and Evolutionary Biology
Yale University
P.O. Box 208106
New Haven, CT 06520-8106 USA

REPLY TO STEARNS: SOME ACYNICAL ADVICE FOR GRADUATE STUDENTS

Raymond B. Huey

Preface

When Steve showed me the preliminary outline for his talk, my first response was to say, "Steve, this is really cynical, even by your standards! You can't possibly present such a negative view of graduate education." My second response was to draft an alternative outline, which I intended as a direct challenge to Steve's, and which I presented after Steve so rashly stormed out of Ecolunch.

A decade has passed since we performed that amusing skit. In transcribing our old outlines into text, Steve and I have tried to preserve the intentionally argumentative, point-counterpoint format and flavor of our original presentations. We do so, not because we remain convinced that our old views are necessarily correct (I am pleased to note that Steve now recants his views, at least in part), but because we want to emphasize a diversity of views of how to be a graduate student.

Our main point is this: there is no one way to be a graduate student. Each of us is an individual - each of us has individual needs, goals, capacities, and experiences. Advice that is productive for one student may be disastrous for another. So think about these and other views, but don't accept them without question.

Initial Premise

Graduate school provides an opportunity for you to change from being someone who reads to someone who is read. That is a major metamorphosis, indeed. Not surprisingly, it presents challenges as well as opportunities.

Always Expect the Best

If you anticipate the worst, you are likely to experience it. Instead, develop a positive attitude, decide what you want (T.A. position, research funds, etc.), and then get it. Go outside your university whenever possible for advice and for funds. Don't merely rely on your major professor. In short, be active and independent, not passive and dependent.

Some People Do Care

People are more likely to care about you if you act like a professional (see below) and if you make yourself valuable. Obtain a skill (multivariate statistics, electrophoresis) that you can share (and of course yourself). Avoid being used, however.

Seek out and collaborate with fellow graduate students, especially ones who are doing interesting work and who are enjoying it. You are likely to learn far more from graduate students than from your advisor, if only because you have more in common and spend more time with them. In short, use these interactions as an opportunity to be introduced to different viewpoints and techniques and to become excited about your career.

Seek out emeritus or near-emeritus professors, at least ones who are still active. They have a wealth of knowledge and experience, and often have the time and interest to share it. Moreover, they can give you a personal appreciation for the history of your field. Science is an historical activity, and progress in science is often enhanced by an understanding of the past.

On "Exhaustive" Thinking

Thinking "widely and exhaustively" can be mentally exhausting if you aren't academically and emotionally prepared. You may instead make better use of your first year by making up deficiencies in your course background (do so as quickly as possible!). Moreover, some people simply need time before they are ready to think independently. That maturation process can sometimes be accelerated by starting your research with a problem that your advisor "hands you."

Ultimately, however, you must begin to think and do research independently, and you must understand why you are doing a particular project.

On Psychological Problems

Expect them. Everyone will go through periods of intellectual insecurity or stress, most likely in the firs year or two. You can often minimize these problems with some simple tricks.

1. Get requirements out of the way as soon as possible. You will be surprised at how much your attitude toward graduate school and your research will improve once you pass all language requirements and qualifying exams. Keep in mind that faculty are inevitably impressed by students who aren't intimidated or slowed down by academic hurdles.

2. Some people simply need time to mature academically. So, fight directives and pressure to complete your Ph.D. in 4 years. You may need to take some extra time or even take a leave of absence. Changing schools or advisors sometimes helps, especially if you can first obtain a Master's degree.

Becoming a Professional

Think of yourself as a professional, someone who will be a biologist for the rest of your life. Start to accumulate a library and reprint collection, develop a computerized list of references and addresses, attend meetings, meet with visiting seminar speakers, correspond with people working on related problems, send out copies of your articles as they are published, etc.

Treat each project (even a literature review) as if it is potentially publishable.

Faculty are more likely to treat you as a professional if you act like one. They are a good source of suggestions in this regard. Ask their advice on efficient ways to organize your reprints and reference files, or ask them to recommend key papers (their own, or those of others) that influenced their thinking and careers. Read those papers, then go back and discuss them with the professor. (Note: Many graduate students have not read most of their advisor's papers, or those of other relevant faculty in their department.)

Despite your best efforts (and theirs), the faculty may have a difficult time treating you as a colleague rather than as a student. Therefore, develop contacts outside of the department and the university, thereby gaining a new perspective on biology and on your own work. Go on a tour of other universities, meet with faculty and students working in your area, volunteer (if appropriate) to give an informal seminar of your thesis work. If possible, spend a term and take courses at another university (or a field station), especially if a course is special and especially if you are spending your graduate career at one university. These outside contact not only broaden your perspectives but may also increase you chances for a collaborative research project, a postdoc, or even a job.

Join appropriate scientific societies, attend their yearly meetings, give papers or posters, get to know your future colleagues. Meetings can be exciting and a chance to find out what is new. Moreover, you get practice at speaking in front of a "foreign" (e.g., nonsympathetic audience).

On Courses

Never pass up a lecture course from a great professor, even if it is somewhat outside your main area. Seek courses that challenge you to think rather than to memorize. Auditing courses can often be an efficient way to get an overview of a field, at least if you are self-disciplined.

Take short courses that can save you time over the years. Many libraries give instruction on efficient literature searches (see also Smith's book, cited by Steve); and most universities offer introductions to computers, statistical packages, etc. If you don't know these critical skills already, immediately learn speed typing and word-processing.

On Proposals and Grants

Grant writing is a key skill. Ask professors for copies of their successful grant proposals (perhaps ask for unsuccessful ones as well). In other words, find out what makes a good proposal before your start writing; don't waste time "reinventing the wheel."

Be a scholar. Showing that you know and understand the literature makes a good impression, and it gives you an awareness of the key issues in your field.

Use the working proposal Steve describes as a basis for a real grand proposal. Many societies, government agencies (NSF), and organizations give grants to graduate students - ask your major professor and other graduate students for the names of such organizations. Prod your department or advisor to start a permanent file on such grants.

Getting your own grant has important benefits beyond simply funding your research. (1) It gives you something to add to your C.V. (2) It helps establish your independence from your advisor and your department. (3) It really impresses your advisor and your committee!

Interactions with Your Advisors

(Tangent. Even after a decade, I can still hear Steve pontificating the first sentence in this section. His expression, "a baroque excrescence," is my fondest auditory memory of Berkeley.)

Onward. A thesis shouldn't be a culmination of your research career, but its beginning. You probably never really had your creativity challenged as an undergraduate. Here is your opportunity. Push yourself - you'll respect yourself more than if you are too cautious and try a no-risk project.

Remember that your future research directions need not be constrained by the topic of your thesis. In fact, your thesis experiences may convince you that your interests and talents are elsewhere. Use a Master's-to-Ph.D. switch or a postdoc to change directions, if appropriate.

Publishing

Contrary to widespread opinion, writing and publishing can be fun. More important, the process of writing is a positive learning experience - my understanding of my own research is invariably enhanced while developing a paper or grant proposal.

Writing and publishing aren't always fun, of course, but you can minimize problems by being careful, by organizing your thoughts before you write, by taking pride in crafting sentences carefully, and by having people critically review your papers before you submit them for publication. This review process should be sequential: First, give it at an "Ecolunch." Second, write a draft and have your fellow graduate students and advisor review it critically. Third

(optional, but advised), send it to one or a few experts in the field. Fourth, submit the manuscript.

(Having now been an editor of several journals and books, I would add several caveats. Make certain you follow the "Instructions to Authors" for the journal: If you use the wrong format, the editor will suspect that (1) your paper was previously rejected by another journal, or that (2) your work style is casual and not necessarily to be trusted. Also, carefully check the citations in the text against the literature cited section. Check text, tables, and figures for accuracy and neatness. (A paper that is neat and well designed is easy to read.) If you are writing an invited chapter for a book, do your very best to meet all deadlines. Editors cherish contributors who actually meet deadlines and follow instructions.)

Publishing is an important responsibility - you share your insights with others. It is also essential. People occasionally get good jobs or a grant despite of a weak or nonexistent list of publications, but the odds of this happening are slim, indeed.

Although over-publishing is a mistake (as Steve notes) don't be embarrassed by writing one or a few minor papers - ample precedent exist. Moreover, we are often our own worst judge of what is truly significant (see Bartholomew 1982). (After gaining the benefits of the experience, you can eventually obscure any truly trivial publications by using the following widely used technique - simply change your official "List of Publications" to a "Selected List of Publications" or to a "List of Publications since 19xx"!)

Miscellaneous

Watch for and take advantage of opportunities. If someone is organizing a special field trip, ask if you can go along and help. If there is a job search in your department, look through the applications and learn first hand what makes a good C.V. and what makes a clear statement of research and teaching interests. (Note: Not all departments permit graduate students to read application files.) Find out your advisor's opinion of the candidates' job seminars. Thus when you start applying for jobs, you will have some idea of what works and what doesn't.

Concluding Remarks

Appearances to the contrary, graduate students need not be oppressed. You actually have as much freedom as you ever have (except perhaps as a postdoc or during a precious sabbatical). Be positive, not cynical.

Postscript

"Ten years later," I wish to emphasize one comment and then make one addition. First, do spend time around students and faculty who are doing significant research and who are

excited about their careers. In short, surround yourself with good people. Enthusiasm is contagious. Second, learn to respect and to practice the art of being organized. Thus, be efficient and don't waste time. This will almost certainly enhance your productivity and your enthusiasm for your career.

Acknowledgments

I am, of course, grateful to Steve Sterns, whose outrageous views prompted this reply. T. Garland, Jr. made useful comments on a draft.

Literature Cited

Bartholomew, G.A. 1982. Scientific innovation and creativity: a zoologist's point of view. American Zoologist 22:227-235.

Raymond B. Huey

Department of Zoology Box 351800
University of Washington
Seattle, WA 98195 – 1800