How to be a professional ecologist….

March 30th 2015

BIOL 470

I'm graduating. What now?

- Graduate school
- Getting a job
- Being a professional (ecologist or otherwise)

Graduate school

- What is it and why would you go?
- Timing: When should you go? When should you start planning?
- Where should you go? How to find a supervisor and a graduate school program
- Funding: What do you need and how can you get it?

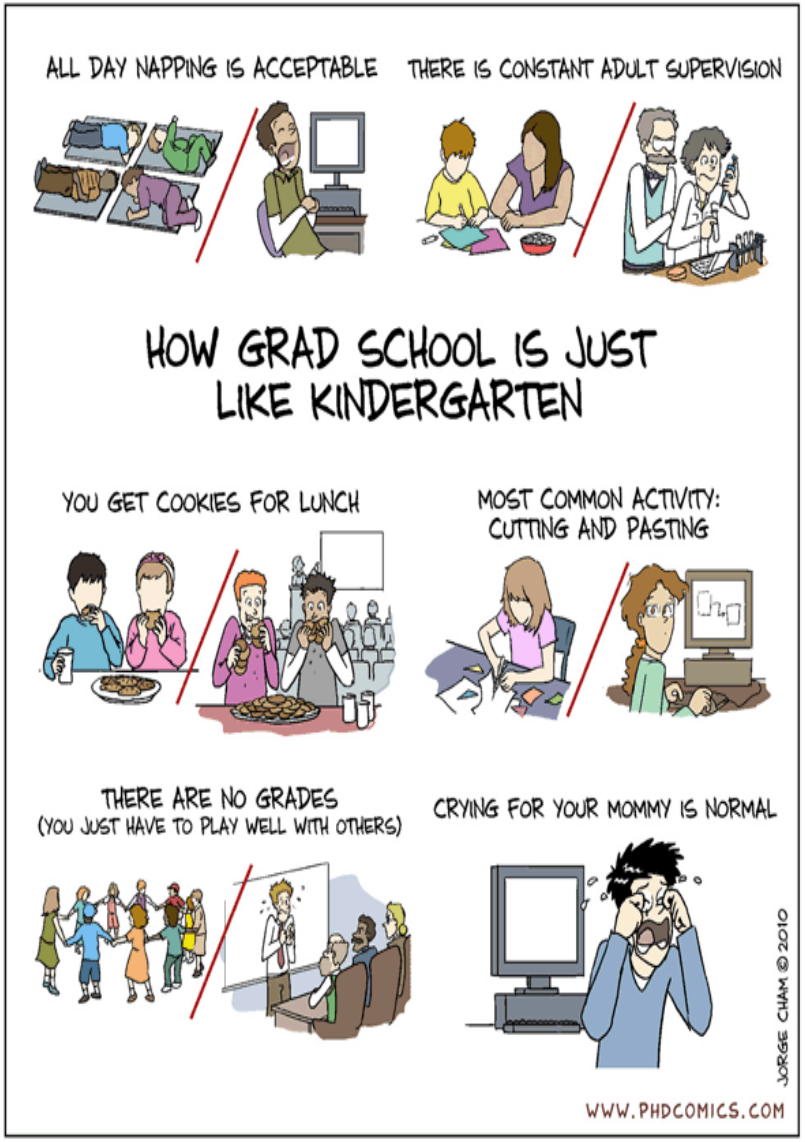
What is grad school?

"Research is formalized curiosity"

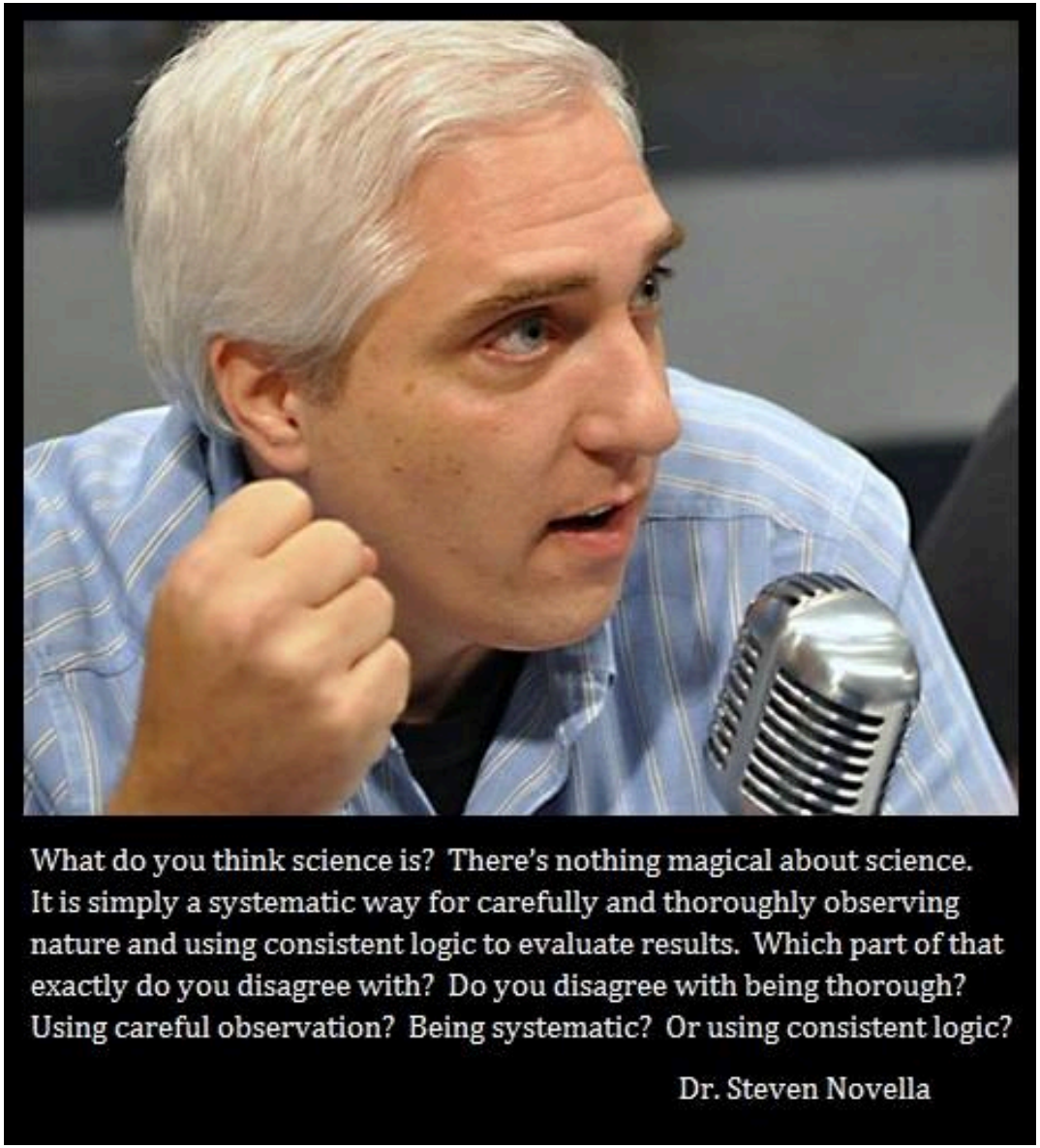
– Zora Neale Hurston

"Graduate school provides an opportunity for you to change from being someone who reads to someone who is read."

–Ray Huey



What is grad school?



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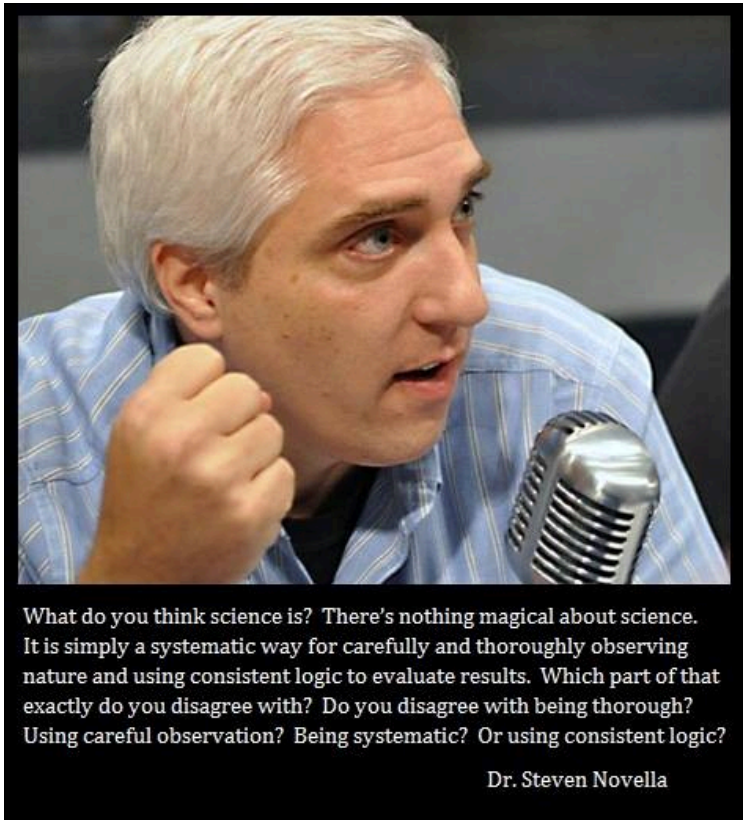

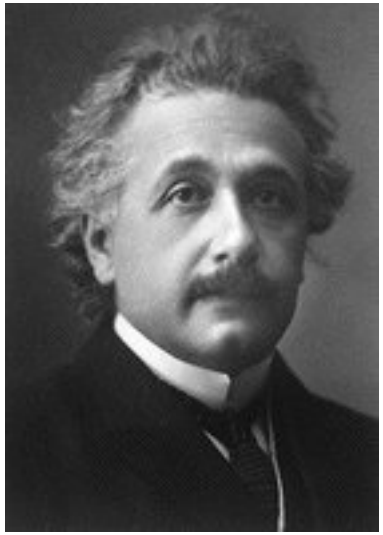

"The mere formulation of a problem is far more often essential than its solution, which may be merely a matter of mathematical or experimental skills. To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science."
-Einstein

The importance of stupidity in scientific research

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Journal of Cell Science

I recently saw an old friend for the first time in many years. We had been Ph.D. students at the same time, both studying science, although in different areas. She later dropped out of graduate school, went to Harvard Law School and is now a senior lawyer for a major environmental organization. At some point, the conversation turned to why she had left graduate school. To my utter astonishment, she said it was because it made her feel stupid. After a couple of years of feeling stupid every day, she was ready to do something else.

I had thought of her as one of the brightest people I knew and her subsequent career supports that view. What she said bothered me. I kept thinking about it; sometime the next day, it hit me. Science makes me feel stupid too. It's just that I've gotten used to it. So used to it, in fact, that I actively seek out new opportunities to feel stupid. I wouldn't know what to do without that feeling. I even think it's supposed to be this way. Let me explain.

For almost all of us, one of the reasons that we liked science in high school and college is that we were good at it. That can't be the only reason – fascination with understanding the physical world and an emotional need to discover new things has to enter into it too. But high-school and college science means taking courses, and doing well in courses means getting the right answers on tests. If you know those answers, you do well and get to feel smart.

A Ph.D., in which you have to do a research project, is a whole different thing. For me, it was a daunting task. How could I possibly frame the questions that would lead to significant discoveries; design and interpret an experiment so that the conclusions were absolutely convincing; foresee difficulties and see ways around them, or, failing that, solve them when they occurred? My Ph.D. project was somewhat interdisciplinary and, for a while, whenever I ran into a problem, I pestered the faculty in my department who were experts in the various disciplines that I needed. I remember the day when Henry Taube (who won the Nobel Prize two years later) told me he didn't know how to solve the problem I was having in his area. I was a third-year graduate student and I figured that Taube knew about 1000 times more than I did (conservative estimate). If he didn't have the answer, nobody did.

That's when it hit me: nobody did. That's why it was a research problem. And being *my* research problem, it was up to me to solve. Once I faced that fact, I solved the problem in a couple of days. (It wasn't really very hard; I just had to try a few things.) The crucial lesson was that the scope of things I didn't know wasn't merely vast; it was, for all practical purposes, infinite. That realization, instead of being discouraging, was liberating. If our ignorance is infinite, the only possible course of action is to muddle through as best we can.

I'd like to suggest that our Ph.D. programs often do students a disservice in two ways. First, I don't think students are made to understand how hard it is to do research. And how very, very hard it is to do important research. It's a lot harder than taking even very demanding courses. What makes it difficult is that research is immersion in the unknown. We just don't know what we're doing. We can't be sure whether we're asking the right question or doing the right experiment until we get the answer or the result. Admittedly, science is made harder by competition for grants and space in top journals. But apart from all of that, doing significant research is intrinsically hard and changing departmental, institutional or national policies will not succeed in lessening its intrinsic difficulty.

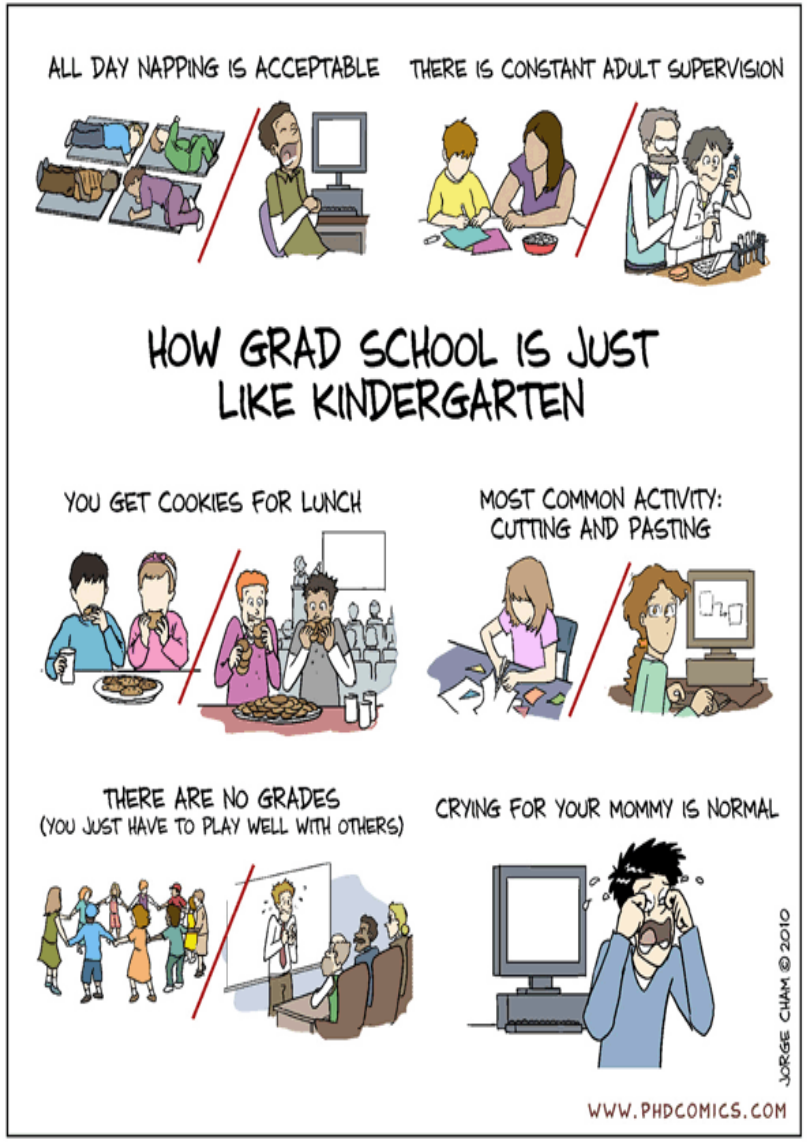
fact, different in our efforts to push our way into the unknown. Preliminary and thesis exams have the right idea when the faculty committee pushes until the student starts getting the answers wrong or gives up and says, 'I don't know'. The point of the exam isn't to see if the student gets all the answers right. If they do, it's the faculty who failed the exam. The point is to identify the student's weaknesses, partly to see where they need to invest some effort and partly to see whether the student's knowledge fails at a sufficiently high level that they are ready to take on a research project.

Productive stupidity means being ignorant by choice. Focusing on important questions puts us in the awkward position of being ignorant. One of the beautiful things about science is that it allows us to bumble along, getting it wrong time after time, and feel perfectly fine as long as we learn something each time. No doubt, this can be difficult for students who are accustomed to getting the answers right. No doubt, reasonable levels of confidence and emotional resilience help, but I think scientific education might do more to ease what is a very big transition: from learning what other people once discovered to making your own discoveries. The more comfortable we become with being stupid, the deeper we will wade into the unknown and the more likely we are to make big discoveries.

Schwartz 2008

What is grad school?

- MSc vs. PhD
- Canada vs the U.S., U.K.



What is grad school?

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PLoS COMPUTATIONAL BIOLOGY

Editorial

Ten Simple Rules for Graduate Students

Jenny Gu, Philip E. Bourne*

Choosing to go to graduate school is a major life decision. Whether you have already made that decision or are about to, now it is time to consider how best to be a successful graduate student. Here are some thoughts from someone who holds these memories fresh in her mind (JG) and from someone who has had a whole career to reflect back on the decisions made in graduate school, both good and bad (PEB). These thoughts taken together, from former student and mentor, represent experiences spanning some 25 or more years. For ease, these experiences are presented as ten simple rules, in approximate order of priority as defined by a number of graduate students we have consulted here in the US; but we hope the rules are more globally applicable, even though length, method of evaluation, and institutional structure of graduate education varies widely. These rules are intended as a companion to earlier editorials covering other areas of professional development [1–7].

Rule 1: Let Passion Be the Driving Force of Your Success

As with so many other things in life, your heart and then your head should dictate what thesis project makes sense to embark on. Doing your best work

Rule 2: Select the Right Mentor, Project, and Laboratory

Finding the right mentor can be hard since it is not always possible to know the kind of mentoring that is going to work best for you until you actually start doing research. Some of us like to work independently, others like significant feedback and supervision. Talk to other students in the laboratory and get their impressions of how the principle investigator's mentoring works for them. In a large laboratory, chances are you will get less direct mentoring from the principle investigator. In that case, other senior scientists in the laboratory become important. What mentoring are they likely to offer? Judge, as best you can, if the overall environment will work for you. A key element is the standing of your mentor in his or her scientific field. When you graduate, the laboratory you graduate from is going to play a role in determining what opportunities exist for your postdoctoral work, either in academia, industry, or other sectors. Your proposed mentor should be very enthusiastic about the project you discuss. If he or she is not, you have the wrong mentor and/or project. At the same time, beware that such enthusiasm, however senior the mentor, may be misplaced as far as your

mentor (Rule 2), eventually you will have to be more independent than when you started graduate school. The earlier you start on that path to independence the better. Independence will play a critical part in your career as an innovative scientist. As much as possible define your own research project with a view to make a significant and unique scientific contribution.

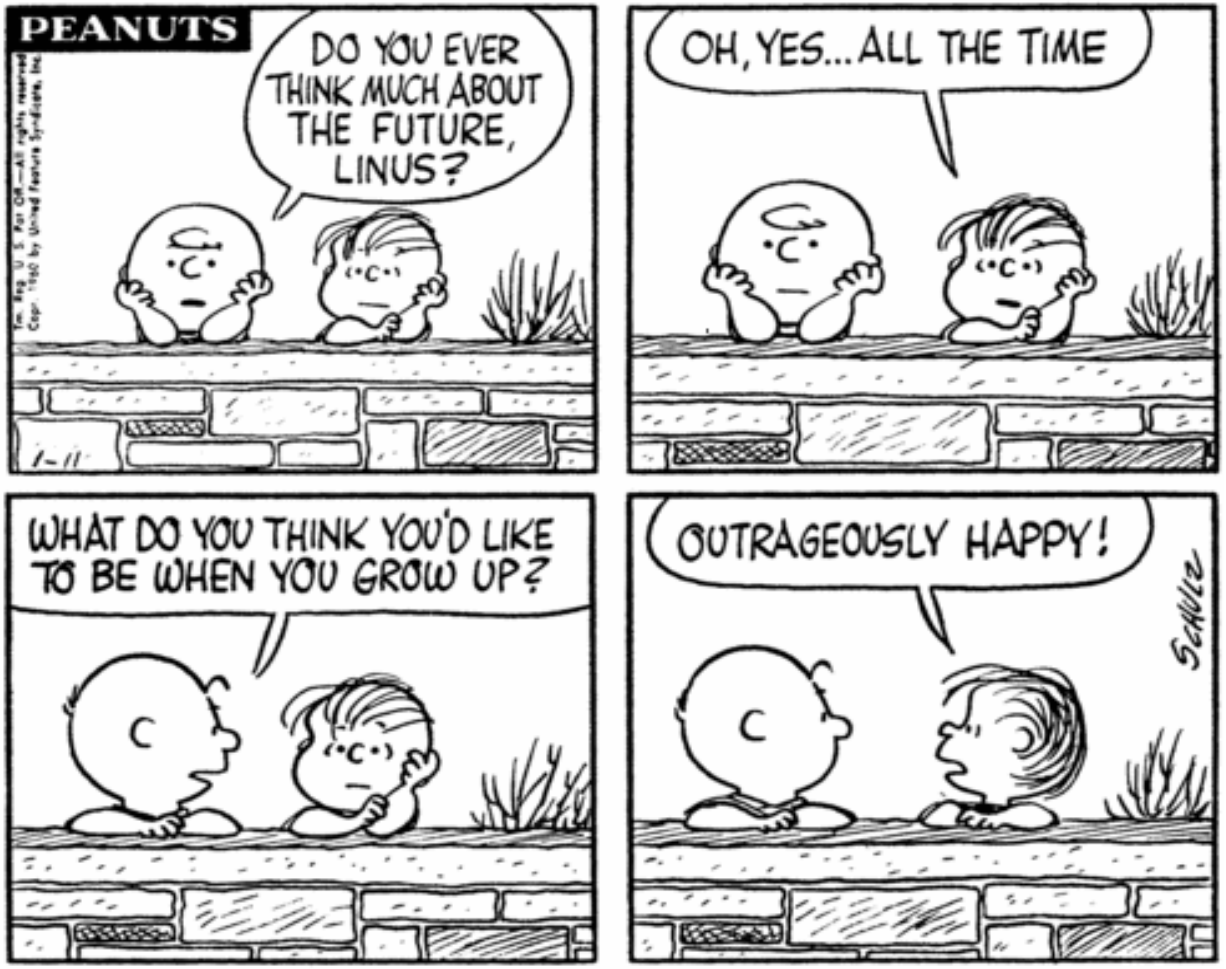
Rule 4: Remember, Life Is All about Balance

Take the time to meet your own needs. Graduate school is highly demanding, both mentally and physically. Your health comes first, spend the time being healthy or else you might find yourself spending more time being sick. Hard work should be balanced with other activities that you enjoy and give you a break. These activities can often become important in your future scientific career. Collaborations sometimes start not because of a shared scientific interest initially, but because you share the same hobby or other interest.

Rule 5: Think Ahead and Develop Your Professional Career Early

There are two parts to this. The first part relates to professional development. Being a successful

Do what you love



Timing is everything

- When should you go?
- If you decide to go, when should you start planning?
- If you're not ready to go, what should do in the meantime?

Where should you go?

- Location, location, location…..
- How to find a graduate program
- How to find a supervisor

Approaching potential supervisors: Writing a winning cover letter

Dear Sir,

Good day.

I am XX, completed BSc in Genetic Engineering and Biotechnology in 2011. My fourth year project was a collaborative research on human microRNA gene prediction which was published in *Genomics, 2012* (Impact factor=3.01). In professional life, from July 2012 to Aug 2013, I worked in the Jute Genome Project (www.jutegenome.org) as a bioinformatician. As a result, I am well acquainted with the bioinformatics approaches as well as molecular biology techniques. I handled genomics and transcriptomic NGS data from different platforms (Illumina, 454, Ion Torrent etc.) for assembly and annotation. I have also done the evolutionary analysis of genomic data. Currently, I am working on viral miRNA gene identification from RNA-seq data using Bayesian method. Additionally, I have proficiency in C, C++.

Approaching potential supervisors: Writing a winning cover letter

I am a molecular biology student and also have experience in computational biology and genome science. And I can take challenges of bioinformatics problems. I am well habituated with UNIX/LINUX environment using command line and GUI. I am highly interested to apply to the MSc in Biology, University of Victoria. I have explored your department's graduate school website in detail, and it seems like an excellent fit for me. If you find my research experience suitable for your project, please allow me to communicate further.

I hope you don't mind my getting in touch, but I'd like to inquire whether you are currently accepting graduate students. I appreciate any time you can give me.

Approaching potential supervisors: Writing a winning cover letter

Hello Dr. Baum,

I am currently a student at Uvic, graduating this semester with a B.Sc. in marine biology. I am extremely interested in conservation biology and ecology and am planning on returning for the Winter or Spring semester. If there are any future openings for grad students I would love to meet up with you to discuss these opportunities. I am available anytime after 11:30 on Friday, 2:30 on Monday, and 2:30 on Tuesday. If no time in the afternoon works I can meet any morning before 9:30. Thank you for your time and I look forward to potentially meeting up.

Sincerely,

Approaching potential supervisors: Writing a winning cover letter

Dear Dr. Baum,

I am finishing my Honours BSc degree as a XX at the University of XX. I am pursuing a PhD in anthropogenic impacts on marine ecology. I am particularly interested in addressing the effects of fishing of predators and herbivores on coral reef communities. I was introduced to your work through your keynote talk at University of XX XX Colloquium earlier this April and I am excited about the prospect of contributing to this aspect of your research.

I think my research interests are a great fit for your lab. I was wondering if you would be willing to chat with me on the phone or on Skype regarding the prospect of applying to do a PhD project under your supervision to start in fall 2014. Attached is my CV (including three references) and transcript for your consideration. As you can see, I have spent my undergraduate studies extensively involved in research in ecology, evolution, and marine biology. I have experience working with R, Matlab, and field research in coral reef communities.

Approaching potential supervisors: Writing a winning cover letter

I am a motivated student and have independently obtained a number of awards to support my research activities. I am applying for the NSERC-CGSM, and I think that there is a good chance that I would receive this funding to help support my PhD studies.

I look forward to your response.

Sincerely,
XX

Approaching potential supervisors: Writing a winning cover letter

Dear Dr. Baum,

I am an undergraduate student completing a double honours major in XX and going into my final year at the University of XX. I am looking to start a MSc program in Fall 2014. I know you said you are not accepting MSc students at this time, but since I love your work so much and I could not find another doing quite the work you do, I thought it could not hurt by asking. I will be applying for NSERC funding this fall, for which I believe I will be quite competitive and I have a keen interest in modelling and experience with R.

I have recently read many of your papers and I am very intrigued by your work studying the role of predators in marine ecosystems and by your use of both empirical and theoretical methods. I have particular interest in understanding how predators shape the community structure and population dynamics within ecosystems, and I also enjoy thinking about the relationship between properties of organisms such as behaviour or life histories and the larger scale community and population dynamics they produce.

Approaching potential supervisors: Writing a winning cover letter

I also love combining theoretical and empirical approaches through modelling. In graduate school, I want to integrate zoological and ecological perspectives of fish to understand their diversity, evolution, and conservation.

I am currently working with Dr. XX on an honours thesis in Ecology involving theoretical work and modelling, and I have already completed an honours thesis in Zoology with my other supervisor XX, from which we are currently developing a manuscript for publication. I was wondering if you have any graduate opportunities available in your lab starting Fall 2014. My ultimate goal is to become a research professor asking conceptual consequences in fish ecology and evolution which are also of practical importance.

I have attached a copy of my CV and unofficial transcript for your consideration, and would be very interested in discussing opportunities with your lab.

Sincerely,

Tips for soliciting great reference letters

Scholarship application resources

Here you'll find resources to assist you with application requirements of external funding competitions.

We've also included tips for scholarship referees. You can provide this information to the academic professionals you select to contribute letters of reference to support your funding application.

– Tips for soliciting great scholarship reference letters

Reference letters are critical to a scholarship application, yet they are probably the most overlooked part of the application process.

These letters are the most important items outside of the applicant essays written by the candidates. All applicants being considered for a competitive scholarship program are already first class, so the letters can help distinguish you from the pack of outstanding applicants by highlighting your uniqueness. The following tips will help guide you to solicit reference letters that stand out.

Choose your referees wisely – you have more control over this than you think!

- Ask prospective referees if they can give you a strong reference.
- Your referee should be familiar not only with your academic abilities, but also your personal interests and background and how those relate to and enhance your ability to carry out the proposed research.

http://www.uvic.ca/graduatestudies/finances/financialaid/scholarshipapps/

Funding

- What do you need and how can you get it?