The Procrastinator's Guide to Grad School: Applying for a Ph.D. in Biology

Step 1. Get going.

This process is a bitch. It sucks, it's no fun, and you'll probably hate it. But here's the thing: you'll learn so much along the way—about academia, about the field you want to join, and about yourself! Cliche, but true. And you know what? If a Ph.D. is the right thing for you, you actually might enjoy it quite a bit. (But if you tell anyone I said that I'll deny it.) This step isn't so much of a step as it is a warning: if you're reading this now and you're thinking "wow I should really do some research on labs for grad school I feel a little stressed" it's too fucking late. Good luck. It's a tough season ahead of you, godbless. Hopefully, this guide will save you some of the time I used up trying to figure out the process.

If it's the beginning of summer, then congratulations. I fucking envy you, but you're doing this right. But still, you're behind schedule because some bastards email their prospective labs a full year before they apply. So you're still behind, pick up the pace.

Well, that was gloomy. Here's the good news. By reading this document (please read it all, I did write all of it, and I tried to make it fun), you've already taken this step. You'll actually know what you're getting yourself into, and you might be able to look forward to some of your immediate future.

A really easy way to properly get started is to decide who you're asking for recommendations, and email them early. Schedule a meeting with them to talk about what aspect of your personage they would want to speak to (they'll probably wave you off once you get to the meeting and say "all good, Gottsie! I'll write you a terrific letter" because that's just how professors are [love ya, A.R.[1,2]!]). I promise that throughout the following weeks you will be surprised by deadlines, need answering of questions, or some way or another need their support, so it's a good idea to ask them early. That way when you screw them around at the last minute due to your own incompetence, they at least have had a long period of dead time while they were anticipating it. Good stuff.

Here's the thing. I'm an exhausted, stressed senior at Princeton trying to do a thesis, finish my own applications, and write this document, so I'm probably going to make some mistakes while I write this. It's 3am. Mea culpa. Hopefully you won't rely on this document as the Holy Grail, but it will help you anyway.

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[1] Big shoutout to A.R. who was an absolute G my entire time throughout this process. He edited my CV multiple times, edited my research statement, wrote me letters of rec, and was generally a really supportive guy.

[2] I've used pseudonyms for people's initials and lab names here in the pursuit of anonymizing this document.

Step 2. Passion 🫶

By the time you're applying to actual labs you'll know much better what you want to study for a Ph.D. But for now, brainstorm. What do you want to do? Look up labs that do it, and figure out what they actually do—look at their lab websites, their Google Scholars, and actually read some of their papers. I kinda knew what I wanted to do going into the process ("rapid evolution and speciation") but by the time I got to the end of the process (and I'm not even there yet), I now *actually* know what I want to do ("evolutionary ecology for conservation"). I'm not sure how that happened. Get to the "vaguely something about rapid evolution and speciation" level for now. You should have a good idea of what you're excited about by the time you're starting to do Step 3 (the next step), but don't let it hold you back. Step 3 is a doozy and you want to get 'er done by the end of summer at the latest. That won't always happen, but it's a nice thought. All of these steps blur into each other much like my vision as I cry tears of my naivety and ignorance lost as a result of this process. So get a good idea of what you want to study now for Step 2, and try to move on. "Done is better than perfect."

This is a short chapter, but don't be fooled. It's scary, because how the fuck are you meant to know what you want to study, and yet everyone is asking you about it and you're writing about it and you're making decisions about your future about it and you don't have a fucking clue what you're doing.

It's okay. Take a breath. The reality is you're probably going to take a gap year anyway (maybe)—think of this as a practice run. Or maybe you've already had your gap year. Then great, this is your chance to figure out where you're going.

Scary? Yes. But also boundless freedom to seek what you want and probably find someone willing to support you in that endeavor? Quite possibly! As you proceed through these steps, you'll get a better sense of what you're actually interested in, and that's great.

I've written this booklet as a linear progression, but the reality is that it's a fucking inductive loop, and you'll have to go through it a couple of times until you feel great about what you've landed on. That's okay, that's the process. This time round, get a good (even if vague) idea of what you want to study.

Step 3. Who, what, where?

You have an idea of what you want to do. Now you need to figure out where you're going to do it, and with whom. How do you find that out? People tell you to look up papers but that's a bullshit idea. Obviously part of the process, because you need to know what these professors are actually doing, but not an easy way of going about it. Here are the methods I used. I'm sure there are many more, but I wasn't smart enough to figure them out.

I do want to say that, despite my earlier derision, reading professors' papers will be a big part of this process. But reading every paper in existence isn't the best way to find the right professors.

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1. **Look up papers**

Listen, I know what I just said, but I feel like if you're applying to grad school you should probably already know that reading papers is a big part of the gig. (Trust me, I get it. Fucking dyslexic over here.)

Here's how it works: figure out what you're interested in, and look up papers using those keywords. In my experience, fewer is better than more. Do your best. Hopefully you will have been collecting some papers over the years (for those of you who know the story, this is the part where I mourn the loss of my beloved Zotero in the swamps of Bocas del Toro. Damned humidity), but maybe you didn't. Time for a good ole literature review. Find some papers that make you go, "cool!" and maybe some papers that make you go, "huh… never thought about that" and maybe some that make you go "I don't get it, but I love it." If you know clearly what you want to study, then try to find as many papers in that vein and skim them or read their abstracts to get a sense of if you like what you see. When you find something that makes you perk up and rekindles your love for research, you've got a winner.

Another trick is to find a series of journals that specialize in what you want to do. I can't promise they'll be the high-impact publications you're excited about, but at the very least it will get you used to seeing the journal's name, style, and common contributors. For me, the journals *Evolutionary Ecology* and *Evolutionary Applications* were the ones to look at—I didn't get a single paper from them that was useful, though. Take that as you will. Searching the big journals (*Science, Nature, PNAS, Current Biology,* and their ilk) with your keywords might work too.

Keep this step brief. It's very easy to make zero progress with a ton of work, especially if you don't know your keywords. To that point no matter how good you feel about your keywords, I can promise you that they're wrong. That term you've seen everywhere but ignored because it felt like it was something totally different—that's the term the people in the literature are actually using to describe what you want to do. Or it isn't. Who fucking knows.

An extra point on this: I spent several months with a *Publish or Perish* exported bibliography of every person who had ever published something to do with "evolutionary conservation" (which *a* isn't a thing and *b* is a thing and it's the wrong thing!)—this list is scary and intractable and functionally useless. In fact, it holds you back, because it makes it feel like the only way to figure out the lab is to fight a long list of publications you don't have time or desire to read (and they're mostly about the evolutionary conservation of biochemical pathways in fruit flies, let's be honest). If you're feeling paralyzed by this approach, know that you're not alone, and move on.

2. **Talk with professors**

Maybe you know someone in the department who studies what you want to study (awesome, especially if you can book a time with them…), or they have contacts they're willing to put you in touch with—that's great! If there's no one at your institution, see if you can find one who isn't too busy from the list you've already created, and arrange a time to Zoom. Meet with them (as early as possible), and see if you can get their take on the labs you should be applying to, the schools that spring to mind, and the keywords you should be using. Is it called "rapid evolution," "contemporary adaptation," "eco-evolutionary dynamics," or "evolutionary ecology"?! (Spoiler: for me, it's all of them. Awful, isn't it. Plus most of the papers I like don't aaaacctuallyy prove that evolution is happening so they say "rapid morphological change" and that's just so vague that I just get hydrology papers when I look it up.)

Interestingly, this is a good step for early and late in the process (maybe even multiple times, if you know the professor well), because they can headstart you down a direction, and they can confirm that you're on the right track. But start it early because late is always late and early is always early, if you know what I mean. If you have multiple professors who are helping guide you, even better. Emailing, talking to, and networking with professors (both your own and at other institutions) is going to be a big part of this process. But don't despair—by the end of it you'll be a god at it. Plus, it's a chance to talk to people in the department whose research you're interested in—great! (If any professors are reading this I'm so sorry that I've just sent so many undergraduates your way… Y'all made my graduate application process so much better though, truly.)

Take your meetings with your chosen professor-guide(s) with a little grain of salt. Trust them, and do an honest look at the places they recommend to you, but remember that they have their own preferences and interests, and they're going to tell you where they would want to go for a Ph.D. if they had to start again now, which maybe isn't what you want. Their networks are based on their own path through science, their collaborators, and their little well-connected subgraph of science people. Multiple conversations with professors means multiple subgraphs to source from, and this is a good idea.

You know yourself, and you are your own professor-guide, minus the professor part.

3. **Use coauthorship networks**

Instead of hunting down every paper about evolutionary ecology, how about we take a look at who's publishing with whom—these common collaborations show you who has shared interests. If you like A, and they work with B all the time, maybe B would be worth your while as well! I found a good number of people this way, and they make up about 50% of the current labs I'm applying to.

Here's a good link to some options, although it is a little out of date: https://bit.ly/grad-school-networks. The co-authorship network generator ResearchRabbit.ai was the most helpful for me, so that's what I stuck with.

Be wary that you don't get stuck in tiny well-connected areas of the graph (as with your professor-guide), and don't worry about fully exploring the network. It's just not possible. The best way I found to use this tool was to start with a paper I knew I liked or a person I thought looked interesting, and start clicking on different people, then clicking on their research, then going into a new coauthorship network, then clicking on people, then clicking on their research, and into another co-authorship network until you're layers deep. Then try to go back a layer and look at someone else, and repeat that until you get bored and need to go to dinner. It's not an elegant process, but I found that the people who turned up a lot were the people I was most interested in anyway, so there's a bit of redundancy in there to help you out.

If you choose to do this, try a couple of different (maybe very different) starting points, and go through the process again. That way, you make sure that you're getting a full sense of the graph, even if you're not exploring every node. Otherwise, you might explore one area really well and get a false sense that you know everyone in the field, even when you don't.

4. **site:.edu "evolutionary ecology"**

If you're applying to biology (and I hope you are, else this is the wrong guide for you), I recommend using the institutional websites, which do a good job of presenting you with information about their professors in a searchable way. The way to do this is to put the "site:.edu" component into your search to tell Google to only look at institutional websites, and then give it your keywords. Use some cleverness to get your search terms right. (For instance, *evolutionary ecology* gets me everything to do with evolution or ecology, but *"evolutionary ecology"* gets me everything to do with evolutionary ecology. Big, big difference.)

If you're trying to coordinate with others applying, you've heard good things about a school's program, or you just want to go to Duke, damnit, then you can also put "site:duke.edu" in there instead, and that will filter for you. I recommend this method for looking at some schools you might want to go to for whatever reason—vibes included—or even schools where you've already found someone you like, because it's really fucking effective. I found one of the places I'm most excited about through this method.

Pair this with option 2 if a professor told you to look at an institution, but couldn't remember the PI's name they're thinking about.

My partner E.S. recommended also broadening your search terms. Don't use the .edu part, and see what happens. Google is a wonderful thing.

5. **Google Scholar alerts**

I actually discovered Google Scholar alerts too late in this process to be useful, but I imagine they could be quite good. You can set up an email reminder that pings you whenever a new publication is released that fits a search term. This is what the finance bros call "passive income." You're sitting there staring at Phineas and Ferb while your professor lectures about neutrinos created at the beginning of the Big Bang, and Google Scholar is doing all of the work for you. This is a double-whammy, because then you can read that paper, email the professor, and get credit for catching the article when it first came out.

If you have professors you're interested in, you can set up alerts for them too, and then you can follow up with them when they publish something interesting, and it gives you an extra opening to gush about how they're the best thing the world has to offer and you'd sell both of your kidneys for a chance to breathe the same air as them, oh please please please accept me into the program!

Where was I?

Anyway, set up those alerts. They're a good investment and if you're wired the way I am, you get a little dopamine hit whenever you see one come in (I might have set up one or two too many on general search terms, too). (Ooh, a new paper on sympatric speciation in moths! Neutrinos, who?)

If you've already emailed a professor and you need to follow up with them, having these alerts is a great way to make your follow-up prompted by something, as opposed to just a follow-up (nothing wrong with a follow-up, either though!): "Oh I just saw this new paper, great stuff, please can we meet at some point per my previous email, pls…!"

I do think there's some merit to using this as an extra way of testing your search terms—does it mostly come up with garbage (for instance, "rapid AND evolution" consistently gives me papers on volcanism and the evolution of higher educational learning, which tells me that I should be using more refined search terms—and no, slapping an "AND biology" term to the end is not a solution, I tried that already). "Rapid evolution" is a phrase that's used, but it's not as common as I thought it would be.

6. **Academic Twitter/X**

I wasn't goated enough to be on academic Twitter—sorry, "X"—when I was doing this process, but my bestie J.Q. is and as he applied to programs, Twitter was really useful for finding professors in relevant areas. It's less targeted, but the algorithm is working in your favour. Plus, who doesn't love a good Twitter doomscroll!

Professors often post on Twitter that they're looking for Ph.D. students, so this is a great place to find openings as well.

Okay, so you have some labs chosen, and you're kind of excited about them. What do you do with them? Well, you can write them on sticky notes that you'll inevitably lose around your dorm, you can clench your buttcheeks and try to retain the information by sheer force of will, or you can do the sensible thing and make an Excel spreadsheet or Google Sheet. Include the professor's name, the institution (I found some conditional formatting based on the universities' names made it quite colorful and pleasant, but to each their own), a due date for the school, and a link to the lab website, their institutional website, and their Google Scholar page (okay that's a lot, but definitely do the lab website, seriously). Throughout this process you will want to refer to what they do, what their website looks like, if they have a kind face, what their email is, whether they're in EEB or Biological Sciences or Integrative Biology or OEB or Ecology or E&E or …, what their grad students' names are, and what they say their research interests are. Save yourself a ton of agro and put the links there so it's an easy process getting them.

I liked putting a bunch of dropdowns rating the labs based on how I felt about them, whether I sent them an email, whether they're accepting students this year, and all sorts of stuff. This also adds yet more color which wards off the sadness.

Finally, if their websites look up-to-date, see if they've put a note about whether or not they're accepting students this year. You can't always trust it, but it's good information to have if you're running behind schedule and need to triage.

I know this seems like a lot, but for every second it takes to include this information in the Google Sheet, you save yourself minutes of hunting down the line. It really reduces the frustration of the process if you have all of the information right in front of you.

Step 4. I really hope you like emailing strangers who have complete control over your future.

No? Okay, well this next step is going to be fun then. You now need to email your prospective PIs and sell them on talking to you. Some will be judgemental and mean, some will stare at you blankly over Zoom and wait for you to make sense of the social encounter, and some will be really genuine and sweet. It's a lottery, so just keep on buying tickets.

The email should include a subject line that'll actually make them open the email (if you can surreptitiously slide your university's name or some impressive title you hold, I find it makes professors much more likely to respond, regardless of why you're emailing them—for instance the subject line "Princeton undergrad on PhD in [name] lab" really does wonders). The email should start with who you are. Then move to what you want to study. Then go to your experiences. Make sure it isn't a laundry list of "I went here, I did that, blah blah, and so now I'm here," but rather it's somehow tied together as if it was all planned, and you're now so prepared to study what you want to study, as if that's been the goal all along. Believe it or not, this sounds less entitled.[3] Finally, blow some smoke up their ass—hopefully, if you've found labs you're interested in, you should actually believe what you're saying. The point of this is to show them that you've actually read their papers and you know what they do (and haven't just read their website). The second point is to show that you're actually fucking literate. If you can synthesize their research to come up with a takeaway about what their lab does and why it excites you, that's awesome. If you can talk about how their papers inspired you to think differently about a concept, that's great too. Just make sure that you read a couple of papers, and you don't just list them like a discussion post, but make them about your interest in the lab. If you can integrate some of your current or past experience into the mix, that's also good, because it shows them you're thinking about synergies and matches between you and them. Save them the trouble, and demonstrate that you can think as well as read. Finally, sign off by asking if you can meet with them to ask about opportunities in their lab—their websites are probably out of date, and this is a good way of leveling the relationship: you want to know what they're doing right now to see if that would be a good fit for both of you.[4]

One of my friends wrote way less than this for his emails and he was fine, so maybe I've overengineered this step. But I did it, and if you're feeling insane like me you can do it too. If you're running behind schedule, the more impressive you are, the more likely professors are to go "ah fuck it, I guess I should talk to this idiot. Jesus."

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[3] Thank you to D.K. for this insight.
[4] Thank you to C.P. for this insight.

Here's the general version of every email I sent:

> **Subject: Princeton undergraduate, prospective PhD in evolutionary ecology**
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> Hello Professor [blank],
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> I am a senior in the ecology and evolutionary biology department at Princeton University, taking minors in mathematics and astrobiology.
>
> I want to study human-induced rapid evolution, particularly in the context of conservation, in my career as a biologist. Short-timescale evolution fascinates me because it brings natural selection alive and into the present—and because it directly applies to how we can understand and ameliorate our impact on the biological world.
>
> I have spent a lot of time in the field, which guides my thinking in evolutionary biology, but I am well-versed in mathematical modes of problem solving, which broadens my ability to approach questions in a variety of ways. Through leading studies on megafaunal river crossings within wildlife corridors, geographical mediation of bioacoustic evolution in poison-dart frogs, and novel methods of assessing the evolutionary significance of conservation management plans, I have learnt to think carefully and methodically about how phenomena arise in complex systems, and consider the full range of their consequences.
>
> [professor-personalized paragraph]
>
> I would love to talk about the opportunities and kinds of questions you are currently pursuing in your lab. If you have any availability over the next week or two, could we arrange a time to call?

Then I add the personalized paragraph. For instance, for once professor I found a paper I really engaged with:

> I was particularly captivated by your *PNAS* paper on fluctuating vs. stabilizing selection. I have been working with fitness landscapes for almost 4 years now, and I think they are such powerful and elegant tools, if applied correctly. In writing the first draft of a paper on how fitness landscapes should be used to evaluate conservation plans, I used 4 or 5 different open-access datasets to demonstrate my point, and many of them were

surprisingly boring (linear, often in only one reduced dimensional axis). Since the inception of that project, I have wondered why, when fitness landscapes should be rugged (or at least Mt. Fuji-esque), the data does not reveal this. Your paper beautifully mends this gap, and provides an important lesson for my future research—multiple years of data are required for interpretable fitness landscapes. I am also impressed by the breadth of the research that your lab does—investigating rapid timescales up to speciation and colonization/invasion. A part of my senior thesis was collecting and analyzing data on bioacoustic traits from poison-dart frogs throughout an archipelago, which bridges those timescales, and has provided a really interesting avenue for understanding multilevel selection.

And another personalized paragraph to another professor:

I am incredibly drawn to your lab because it is focusing on the most important aspects of the biodiversity crisis that also appeal to my scientific curiosity. Your articles on spatial autocorrelation in pumas to evaluate anthropogenic impacts on male dispersal included a beautiful blend of genetic methods and ecological theory, with an evolutionary impact; not to mention the importance and value of performing review papers in fast-moving, growing, and impactful fields such as conservation-focused evolutionary ecology. Your article on "circling the drain" in *RSPB* clarified for me a point which I have felt for a while but have been unable to verbalize about the way that biologists are approaching the 6th extinction. And I was thrilled to see that your lab also performs research on rapid morphological adaptation in anthropogenic environments (such as your paper on rapid island gigantism in white-bellied rats), which is what I would be most excited about studying for my PhD. My ideal PhD would use fieldwork, review papers, and theoretical modeling to determine how evolutionary ecology—specifically rapid morphological adaptation—can be leveraged to conserve species in changing environments. Your lab's focus, drive, and attention to what matters most would be the ideal place for me to perform this research.

And another:

In reading your recent papers, I was drawn to the fact that your lab looks at all levels of evolution and organisms to understand urban adaptation. The fact that you have published papers examining claw shapes, overall morphology, and

> genetic signatures of selection, and you have published papers looking at phylogenetic patterns of exaptation, parallel rapid evolution, and the "halflife" of hurricane selective signatures shows breadth that really appeals to the integrative biologist side of me. From a methodological perspective, your lab clearly utilizes publicly accessible data, performs thorough fieldwork, and takes a meta-perspective on the growing field of urban evolution, which aligns well with the variability in analyses I would want to pursue in a Ph.D. It got me thinking about how understanding patterns of urban evolution could apply to guiding species towards urban phenotypes as a method of conservation (e.g. for habitat-limited species on Caribbean islands): which morphological components are most selected-upon, how does the organisms' phyletic history constrain them, and how genetically tractable is the evolution of this trait?

You get the idea. My first email took me 4 hours, my second took me two hours, and by the end I was cranking them out one or two every hour. There's a learning curve, and you'll figure it out. Or you won't. This is why we start early, kids. (It's okay. I know you didn't. We can suffer together, bestie 🫠.)

Look at your professors' lab websites (you wish you put those links into your Google Sheet now, don't ya!) to see if they want you to send anything specific—some want a transcript, some want a research statement (greedy bastards—as if they know I missed the GRFP deadline), and some don't tell you anything. You always want to include a CV, though.[5]

So that brings us to part 2 of this process. Make your CV, and cram everything you can in there. Put field experience, projects you've done, conferences, scholarships, grants (include dollar amounts), skills, all that stuff—be sensible, but thorough. Maybe even put a paragraph at the top of your CV—a sort of abstract that includes your research interests and a summary of your CV.

Have a professor edit your CV—an emeritus or close-to-emeritus professor is likely a good choice for this, because they have time. But also, they might not be as up-to-date on stuff. But you need a warm, professorial body to look it over, so get what you can get. If you're lucky, you'll go back and forth with them sending PDFs and edits you should enact, and you'll get a killer CV out of it. They'll likely remove a lot of the stuff you put in, but that's the point: they know what matters and you don't.

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[5] Another shoutout to A.R. for this gem.

With all of this done, you're ready to start sending emails. This part of the process was deeply frustrating but also really valuable. By reading papers—actually reading them, not just skimming their abstracts—I got a strong sense of what the field is. It isn't a full literature review, but it's enough to feel knowledgeable, inspired, and give you lots of ideas about what it is you actually want to study.

That's why this process is a mind-fuck. The further through the process you are, the easier it gets, and you wish you knew what you knew now at the beginning. As I said before, I've written these parts of the process as steps, but in reality this is a fucking flow diagram, and you have to iterate a couple hundred times until you feel remotely good about the places you're applying to.

Step 5. Now you get to Zoom them.

If you did Step 4 right, you probably have some responses. Professors are busy human beings, so don't take it personally if they don't respond to you. Maybe they didn't like your email, maybe they saw it and liked it but their toast popped up just at that moment and they'll never think about you again. Oh well.

But you might have some responses, and if you do that's awesome (if you don't, no sweat—keep on going, and maybe work with friends and professors to see if you can improve your email!). Some responses will be very positive, especially if you have experience, enthusiasm, and were emailing the right people. Other people will be very judgemental and make you feel shit about emailing them 2 weeks before the submission deadline (another reason to start early). This happened too. Roll with the punches, it's worth it in the end.

When you meet with them, they will invariably ask you what you're interested in—you should have an answer! If it seems like a pie-in-the-sky sort of thing (e.g., "leveraging evolutionary ecology to support conservation efforts") maybe have some examples or hypotheticals ready to go. They'll probably ask you about a system you'd want to work on—don't feel a need to invent something uber-specific, but maybe find a description of a kind of system (marine, terrestrial; invertebrate, vertebrate, plant, fungus, bacterial, viral; lab system, field system; experimentation, observation). If it isn't obvious from your interests, they might ask you about fieldwork versus lab work versus modeling. Be sure to tell them what you're interested in, not what you think they want to hear.

Some professors will sit there and ask you a million questions to determine if you're good enough to be worth talking to. Some professors will ask you about your research and then give you the floor to ask a million questions (I sure hope you have some ready!). Some professors will log onto the Zoom and say nothing. Be prepared for bizarre interactions, it's okay. We're all awkward.

A good opening question I like, if they give you the floor, is asking them how they see their lab, what they feel they do best, or what drives them forward. You've obviously done your research, and it doesn't hurt to mention this, but it then allows them to profess about the thing they love, all while you get important information about the lab you're considering joining.

If there's an aspect of their lab that doesn't quite fit, or an aspect of your interests that doesn't 100% mesh, it might be worth bringing it up (after all, you want to know today rather than in two years when you're cursing their name for not using understanding the goddamn epigenetic methods you're using in your dissertation). A lot of labs do awesome evolutionary ecology work, but they don't do too much conservation—some of them were excited about the prospect of branching out, others were horrified by it. Good information to know!

You should also ask about financial support. Where does the lab funding come from, where does your funding come from? As a result, how much control over the direction of your

research will you have (on the scale of starting a new system down to being handed a project on day one and being expected to just do it)? How much teaching will you have to do? Are there any fellowships you should apply to? If you're doing work outside their grants, what would applying for funding look like? (Would it be internal or external grants? How competitive are those grants? How likely are you to be limited in your Ph.D. by lack of funding?)

An important point I should mention here is that depending on whose funding you—the lab or the department—your hands may be thoroughly tied in terms of what kinds of research you can do. If your stipend is funded by a high-altitude physiology grant, then friend I have news for you: you're studying high-altitude physiology! The GRFP (see Step 7) and other funding sources substantially complicate this, because if you're independently funded then theoretically you have more say over what you study… theoretically. Hence, ask them the question.

Ask them how the stipend compares to cost of living, if you feel comfortable (see also phdstipends.com to get a sense of how much they're likely to pay you enough). As of right now, there are only a handful of programs that pay a living wage. Buena suerte.

There are three axes of grad schools, governed by three questions: Do you rely on TAing for funding? Is funding guaranteed? Do they pay you a living stipend? Figuring out where each school lands in this 3D alignment chart is super important for figuring out what your life will look like for the next few years.

And finally, a question that pays dividends wherever you ask it is "what should I be asking about? What don't I know that I don't know, that's actually really important?" Which is great because it often sounds really smart but is actually an admission of idiocy (or at least, ignorance)—a big score for cognitive dissonance right there—and also asks a really important question which will add to your list of questions for your next meeting. (This question actually works anywhere with very little modification, and I fucking love it. Use it. Spread the word.)

My father also has some incredible advice for going into interviews: create a list of the 10 questions you wouldn't want to be asked, and then create a list of some incredible answers. If you're praying they won't ask you about it, that's an excellent sign that you should prepare a kick-ass answer.

Finally, don't stress about it. You'll figure it out. If talking to them makes you sad-uncomfortable (as opposed to wowed-uncomfortable), then it's not a good match anyway. I had one professor basically berate me about not emailing him soon enough, and then quizzing me about why my field experience didn't line up with my intended research questions. Umm… okay, sir. You know I'm an undergraduate, right? But that was a great experience! That's $95 on application fees I no longer have to pay. Nice.

Step 6. Write, write, write.

The most exhausting part of the process is finding and emailing professors—the stress, the monotony, the confusion, the frustration. But the pinnacle of the essence of the process is the research statement. This is what your potential PI, grad committee, and admissions board will all read and reference when they're making decisions about you. It's basically the entire application—yes, there's a DEI/personal statement, and yes, for *some* (I wish it were all) schools, that's also important, but in most cases at the moment the DEI statement takes a back seat to the research statement. Your research statement is meant to encapsulate everything that you study, want to be, your experience and preparation, and why you deserve the Nobel Prize already. I jest, but only a little.

The structure of this document is important, and hard to get right. You want to burst out of the gates with a killer first paragraph, but you don't want to just cram information down their throat. I started with a paragraph that introduced my own introduction to my subject area in a compelling (I hope) way:

> Before I even knew that the field existed, I have been fascinated by evolutionary ecology. Officially, I was inducted into the field via a graduate lecture given by Professors Peter and Rosemary Grant, and at the after-party, where I was introduced to the Campbell-Staton Lab's work on rapid evolution. My first project that incorporated evolutionary ecology, however, was three years prior, in the summer before my first year at Princeton. While exploring a dataset on sea turtle hatchling dispersal I helped collect, I realized that *in vivo* fitness landscapes could be utilized to determine how organisms experience selection in real-time—not a novel concept to the world, but a riveting one to me. Inspired by these results, I wrote a manuscript on how fitness landscapes could be applied to conservation by appreciating that conservationists and evolutionary biologists both study the same thing: survival and reproduction. This project represents a critical skill I have developed throughout my short tenure as a biologist—the ability to innovate at the border between evolution and ecology—and as this project progresses it provides me with greater insight into how evolutionary ecology and conservation might go hand-in-hand.

It says what I'm interested in and captures the interest of the reader. Then it demonstrates that I'm driven and a go-getter (e.g. going to a grad lecture and after-party as an undergrad—I knew this was important because multiple professors commented positively on my attendance at these events). Then it says that I actually have my own, independent experience with the subject, and how it captured *my* attention, and a personal success in the area. Finally, I segue from my interest

in evolutionary ecology to my interests in evolutionary ecology (see what I did there? Interest, like passion, then interests, like expertise. Hilarious.) Everyone's first paragraph will look different, but the point is to make it personal, punchy, and powerful. What is unique about your experience? How does your life experience make you want to pursue the specific ideas you're interested in? I found that the intrigue in mine—how did I first interact with rapid evolution years after I ran my first project in it?—is what sets it up as compelling. It isn't just a history, it's not even an anecdote, it's a paradox (project before introduction) that quickly reveals itself to be an insight (I've worked at the front of evolution and ecology my whole life). Already in this paragraph I've told them what I want to study, that I have a knack for it, that I'm a go-getter, and I have passion for what I want to study. Notice that the entire paragraph is one (maybe two) ideas, though: how was I introduced to evolutionary ecology?

The next step is to talk about your interests. I did this in two paragraphs, starting general and then introducing my specific questions:

> Today, my focus is on how species evolve in anthropogenic environments, and how evolutionary ecology can be refocused to support conservation efforts. In different systems, these questions may go in a broad array of directions that will be highly system dependent and may have to do with rapid evolution, incipient speciation, or the ecological impacts of evolutionary fitness. The breadth of this question is both massively appealing and a terrible risk; specificity is required for a successful dissertation.
>
> The specific questions that drive me focus on organisms and populations, with a particular interest in morphology and genetic signatures of selection. Throughout a Ph.D., I would want to answer questions such as: How can we facilitate urban and climate adaptation in species threatened by these risks? What perspective does evolutionary ecology provide for evaluating conservation plans for threatened species, and diagnosing their declines? How can we assist niche differentiation and trait displacement to support endangered populations in the face of invasive species? While these questions may initially appear too broad, they are malleable enough to apply to different systems, and to continue to guide me as my skills and interests advance.

Now you talk about your experience. What have you done that will set you up for success? This is a substantial part of the statement, and I wrote mine in chunks: field and data analysis experience, mathematics experience, experience at conferences and scholarships, and then drilling down on a specific substantial research experience (my thesis). Here it is in full:

> I believe I am well-equipped to ask—and eventually answer—these questions as a result of my experiences at Princeton, from the field to the blackboard to the code

editor. In Kenya's bush-savanna, I was given opportunities to help untangle nonlinear, spatial, and environmentally-driven human-wildlife interactions two years in a row. Online, I worked closely with Professor R investigating hypothesized livestock-zebra mutualisms and how different species respond to anthropogenic landscapes of fear. The following year, I led fieldwork to determine how river crossings impact wildlife corridors in a mosaic landscape of pastoralism and protected land. These projects thrust me into learning to think carefully and methodically about how phenomena arise in complex systems, and consider the full range of their consequences, modes of thinking which directly apply to picking apart the nested feedbacks often found in evolutionary ecology. During field courses in Panamá, I developed skills in project curation and execution, and produced quantitative work on brittle star-substrate affinities and the morphological evolution of midges' antennae for species-specific interactions, demonstrating for the first time that that frog-biting midges use their antennae to sense sound waves. One of these manuscripts has been submitted to *Marine Ecology*, and the other is set up for submission to *Current Biology* this year.

My interests have also taken me to mathematical modeling and simulation. For my minors in astrobiology, I have produced a manuscript on the impact of trophic structures on the vertical distribution of life on Europa, Jupiter's icy moon, which I am soon to submit to the *International Journal of Astrobiology*. For my mathematics minor, I have developed two applications of thin-plate splines to population trend estimation using dimensionality reduction analysis. For a current mathematical ecology class, I constructed a Lotka-Volterra-inspired matrix differential equation to evaluate whether geographical feedbacks can facilitate sympatric speciation in a metapopulation.

These projects have taken me to four conferences—two posters at the American Natural History Museum, one oral presentation to the International Sea Turtle Symposium, and an invited oral presentation to Princeton's own Mary W. George Research Conference—and my interests have led me to guest lecture on how satellite data can be used to classify land-use for conservation (including my own applications of MapBiomas' method) in Princeton's Sustainable Futures writing class. As a result of this trend of research, I was selected to be one of 50 Udall Scholars, a prestigious fellowship that supports students who have shown dedication to a career in environmental service.

To fund my senior thesis, I received the Becky Colvin Memorial Award for the academic and practical implications of my research, an honor bestowed on only three students each year, and declined three further grants. Over two months in Bocas del Toro, Panamá, I independently collected recordings of strawberry poison-dart frogs' (*Oophaga pumilio*) advertisement calls across two islands and five population centers to understand how locally heterogeneous acoustic

> environments promote evolution in the face of sexual selection. By programming a digital signal processing infrastructure, I extracted 23,892 usable calls from 101 frogs. Bayesian multilevel modeling, though unconfirmed, appears to demonstrate that heterogeneous bioacoustic habitats expand both the individual and population variation of key traits, such as peak frequency, as compared with frogs from populations with only a single habitat. Next steps involve using artificial fitness landscapes to determine how variation decreases the overall fitness of a population, to apply these results to the contemporary urban (mal)adaptation of endangered frogs.

It's hefty. This part will look different for everyone as well. I happen to be interested in both fieldwork and modeling, so I have a range of stuff to talk about, but this is less common. Going to Princeton meant that I was able to do really cool research across the globe. I recognize how lucky and privileged I am to have been able to do that. Everyone's experience is different, and we need lots of different people with different backgrounds to fill Ph.D. programs if we hope to actually understand the world. Don't be afraid to toot your own horn and shout out your accomplishments: talk about final projects from classes—and if you are trying to get them published, call them manuscripts—describe your volunteering experience if it pertains to biology or conservation. Talk about *any* money you've been given to do research, attend college, to go to conferences, or to travel. Grant money and publications (above all else, unfortunately) are the currency of science. If you have either of these, make a point of saying it. I talk about various journals I'm submitting to (notice—I don't have any publications, but I still talk about where I'm trying to submit), and I distribute these throughout the paragraphs. I spend a whole paragraph on conferences, and list them all. I talk about a scholarship, and explain why I got it, and what it means. These things are important—it's how your PI, readers, and grad committee convince everyone who matters to accept you.

Next! Talk about what you'll do with a PhD, what you want to do with your life afterwards. Show you have some sort of a plan. You're trying to convince them to invest in you, so you have to answer the question: why are you a good investment?

> Throughout my career in academia, I will continue to address the question of how evolutionary ecology can be refocused to support conservation. Whether I become a professor, part of an NGO, or start an independent lab, my work on this subject will carry on. I am excited to dedicate my life to this pursuit.

The last paragraph I think is the most important. What's required here is that you explain why you're interested in the lab, the university, etc. But then the magic ingredient, in my opinion, is that you invent a potential project you could do in your prospective lab. By doing this, you demonstrate to your PI, the graduate committee, and the department at large that you know how

to fit into their world, and show that you are able to mesh your interests with those of the lab you would be joining. For instance, one of my final paragraphs was:

> At Case Western Reserve University, I would be thrilled to work with Professor S.D. Her lab's research on evolutionary ecology in the Anthropocene is unparalleled and I believe that it would provide the best intellectual environment for me to pursue a Ph.D. Her research takes in social, ecological, environmental, and evolutionary perspectives to produce insights that span theory and application, such as her work on eco-evolutionary feedbacks in urban environments and on the capacity for at-risk species to adapt to climate change. This systems approach, mixed with her emphasis on phenotypic evolution at the level of the organism and population, aligns incredibly well with the conservation perspective on evolutionary ecology that I want to utilize in my research. In the D. Lab, I would want to pursue the evolutionary ecology of hawksbill sea turtle poaching and bycatch in search of morphological, behavioral, and genetic determinants of success in a human-dominated marine environment, asking questions such as: which traits or life-history strategies are involved in escaping or avoiding intentional and unintentional harvesting? I am confident that the D. Lab and CWRU would be able to provide me with the best support I could ask for to succeed in this endeavour.

My Cornell final paragraph was:

> I would be thrilled to work in the V. Lab. Professor V.'s research on the interactions between adaptive plasticity and genetic evolution, and on phenotypic variation in tree swallows is incredibly exciting to me. I believe that I would be able to contribute an additional facet to her study system—bioacoustic evolution. The second part of my senior thesis is studying how natal philopatry in tree swallows (as compared to barn swallows) contributes to their acoustic adaptation to noisy, anthropogenic environments. If swallows adapt their bioacoustic traits to local acoustic environments, it may further reduce gene flow between populations due to assortative mating by call—this may cause rapid incipient speciation. I would be incredibly excited to continue this research in Professor V.'s lab, and develop a framework to understand which avian species are at risk of beginning the process of speciation, and losing connectivity between their populations.

I think this last step is so powerful because so few people do it, so it sets you head and shoulders above everyone else. It demonstrates that you are mature enough to do a PhD, and that you would be able to hit the ground running. It saves them thinking, "wow, what would this guy do in my lab? Would I have to babysit him, and figure out something for him to do?"

Step 7. Get that cash!

Here's something I wish I'd done. Apply to the GRFP. Your odds of getting it as an undergrad/pre-grad are 30% I read a while ago. That number drops significantly once you've started as a real grad student. And you can only apply once in grad school, but you get an extra, free chance to apply as a pre-grad. The catch: the deadline is in mid-October. So, if you're like me, and you had barely even made a folder called "Grad School" by October 20th, you've missed the boat on this one. I include this as Step 7—not Step 0—because this is my experience of grad school applications. I'll put it this way: you're reading a booklet called "The Procrastinator's Guide." We're all in the same situation here. There's no judgement.

The trick is that if by late September you've already found a PI you're really interested in, you can talk to them about getting some concrete ideas for a GRFP application, and they'll often help you write it! This implies some level of commitment, so tread carefully.

I have no advice because I didn't do this. But the one thing I know is that they fund the individual, not the project. When you tell them about a project you want to do, you're basically telling them "this is what I can come up with on a month's notice—imagine what I could do in an entire PhD."

The funding is a sweet, sweet package, and gives you a lot of control over what kind of research you pursue in any lab.

Now, if you're getting here and thinking "fuck! I didn't do that! I'm totally screwed!" Calm down—life is a Markov process[6], and you just gotta ride the waves. You'll get 'em next time, tiger. I didn't do it, and I'm applying for the GRFP next year. It just means I need a good sense of what I'm doing sooner rather than later—that's probably a good thing!

I've seen people write blogs about applying to GRFP, totally bombing everywhere they apply, and then getting accepted to high-quality institutions that didn't have enough money for the extra space. The argument goes: if you rejected me because of a money problem, then I'll bring the money. Can you accept me now? I have no idea if this works. But if you applied to the GRFP (and you got it), then this is a nice ace to have up your sleeve.

[6] Thank you to S.P. for this incredible quote.

Step 8. A weekend from hell.

The last step in the process is the interview weekend. If you've been invited, you will be interviewed by anywhere from 2 to 10 professors about your fitness for the program. This is a cool opportunity to get insight into the kinds of people who will be on your committee, the kinds of conversations you'll have with the big dogs at the department (arf, arf!), and so on. For me, these conversations made me hate schools I was previously neutral about, and love schools I had previously discounted. Interviewing made me love Cornell, where I am now.

Strangely, these were somehow very easy compared with the rest of the program. Most programs accept two-thirds of interviewees (I was accepted to 2 out of the 3 places I was given an interview, so that checks out). Every interview is much the same, and you can rely on this. Together, they make this step not necessarily chill, but definitely less sweat-inducing.

Almost every professor will ask you what your background and interests are, and what you want to study. I made a little mindmap that I could follow to guide me through each of the points I wanted to make. I had one branch for what my PhD would look like (evolutionary ecology + conservation), another for my research experience (my senior thesis).

At this point you should be relatively good about thinking about and talking about your PhD. You've probably had conversations with friends, peers, PIs, and family members about it, and you might have become good at nutshelling. Talk about what you're interested in, what that means, and what that might look like.

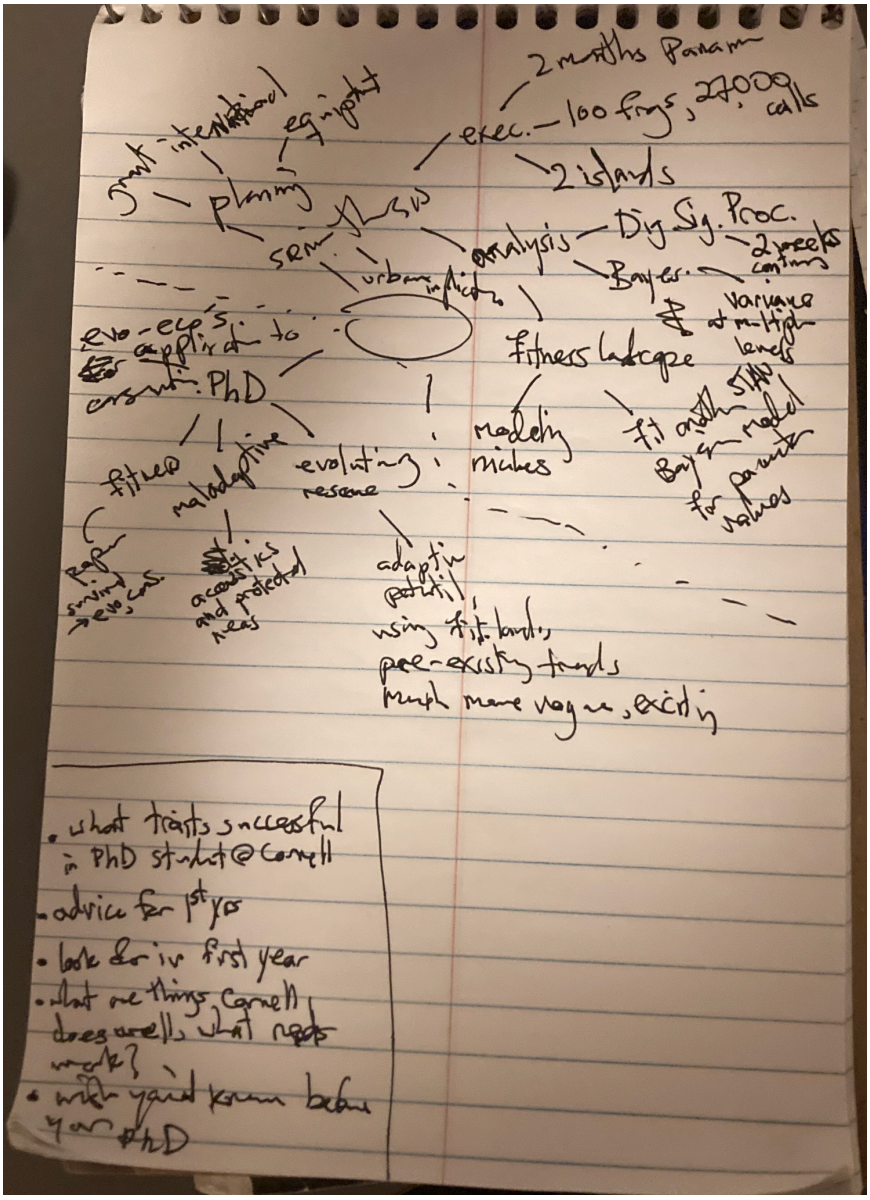
For my experience, I chose to talk just about my senior thesis, and I walked through all of the bits: I had to apply for a grant, plan international fieldwork, buy equipment, arrange flights, and so on. I spent two months in the field, collecting 23,000 calls from 100 frogs. I designed and wrote an algorithm to extract calls from raw audio data. I used Bayesian analysis to understand how frogs adapt to heterogeneous acoustic conditions. I'm now modeling this system using fitness landscapes. By going through every step, I walk them through what was required for me to be successful in this, and help them realize that I would be able to do all of these things when performing my dissertation fieldwork. I'm demonstrating that I'm mature enough—intellectually and logistically—to do a PhD. Once again, I'm showing them that I can hit the ground running.

If you've done truly independent research (and I promise many of you did), go through all of the steps of that. Really hash out all of the logistical and intellectual work you did to pull it off. Make a point of mentioning that you applied for your own funding, that you planned your own summer, that you spent months in the field, that you used up 13 million hours of processing power. Talk about writing that up, talk about presenting that, talk about facing challenges. Make it clear to them that you sweat for your project—because if you did an independent project, blood and sweat were surely involved, and they want to see that dedication.

Finally, write out a little list of questions that you can ask multiple professors when they ask you if you have anything you want to know. Broad but specific is good. For instance, "what

traits do you find are successful in a PhD student here?" or "what advice do you have for first years?" The latter here is also good because it suggests a preemptive close: you're asking for advice, so you're showing that you're expecting to get a PhD (somewhere), and you want to do your PhD as well as possible. Another good one is "what do you wish you'd known before you did your PhD?" which works best when the professor is younger. Finally, "what are the things that this institution does well, and what things need more work?" shows you care about being in the right place for you, and knowing it fully—warts and all—before you choose it.

I kept my notes in front of me for every single interview. Eventually, after multiple rounds of basically the same questions, you'll get a good flow, and you'll only need to look down to remind yourself of where you are if you get distracted or lose your train of thought for a moment. Here are my notes:



I also recommend making a list of 10 questions you don't want to be asked, as before. This is just generally good advice for any interview. And because you're being interviewed again and again and again (especially if you have multiple schools interviewing you), if someone asks you a question that stumps you, you can regroup before the next interview in case they ask you again. One question all of the faculty asked me at Cornell was "so the V. Lab… are you interested in endocrinology? You love birds? Why this lab?" The first time I was asked this, I was caught a little off-guard (were they right—was I applying to the wrong lab? Did they think it was a bad fit?)—and after a moment of mumbling I managed to coax out a decent explanation. For the next interview, I was ready for the question, and my answer was much more sure of itself. (I later asked my PI if I was correct in applying to her lab, and if so, why? And, fortunately enough, her answer was the same as mine! Thank you for accepting me M.V.! I am beyond lucky!)

Remember that these interviews are a chance for you to get to know the faculty, and see if you want to spend the next 6 years looking up to them. It's okay if you get the ick—there was one program I was frankly happy to be rejected from, because I felt totally uninspired by the conversations I had with the faculty. All part of the process, babycakes.

Step 9. Free vacayyyyy!

If the stars align and you get accepted to a program: first, congratulate yourself—this is a big accomplishment. Simply getting into a Ph.D. program is incredible.

Next, see if they'll let you visit! Some programs will have a (completely, totally free) coordinated visit weekend, and others will have you ask your PI if you can come and visit, or the PI will offer themselves. My one advice is this: unless you are totally, totally, totally confident there is a zero percent chance you would go to the school (in which case, why did you apply?), you should visit. Life is fluid, your feelings and circumstances change, and you want to have all of the information you can. And from their side, the school, lab, or PI *want* you to visit, because that's their best chance of convincing you that you should go there. Do both of you a favour, and just visit. If you feel awful while you visit trying to imagine yourself doing a PhD there, then you have your answer. If you don't want to leave, and you're stepping onto the aeroplane looking forward to coming back and starting your dissertation, then you also have your answer. Win-win! Either way, it's a free vacay. (Well, minus the vacay.)

When you visit, get enough sleep. I got like 6 hours of sleep maximum throughout this process, except for the visit days. Then, I got 8 hours minimum. We store memories when we sleep, and you're gonna want these memories for when you sign on the dotted line and accept a program. You'll particularly want them if you're struggling to make a decision. So sleep, just this once. It's good for you, I promise.

Step 10. Sleep, and ponder.

Big decisions ahead of you, kiddo. Take a break, consider your options, and relish in a job well done. And if you didn't get any options you're happy with, then take a breather and start at Step 1 again, because the next cycle is just around the corner. Ultimately, we all have our path in this world. Feel free to reach out.

The breadth of topics an advisor will be willing to advise are funding, tenure, and personality based