Transitioning from a Liberal Arts Education to a Research PhD

By Tina Cai ‘23, Climate Action Fellow
qcai17@ucsc.edu

Resources for applying to EEB related PhD programs

Reflection

It has been an incredible four years being a student in the Biology department at Middlebury, and it was also great to see how much the department has grown throughout the past years. I am so grateful for all the help that I’ve received from the department and from all the amazing Biology faculty members, who introduced me to research and provided me with so much inspiration and so many great ideas. As I am about to transition into grad school, I am putting together a guide to graduate school application (specifically for Ecology and Evolutionary Biology programs) reflecting on my personal experiences as well as highlighting things that I wish I had known. While the following guide was primarily based on my own experiences, I benefited hugely from conversations with past and current graduate students, Middlebury alumni, faculty and friends, who all played important roles in guiding me through the application process.

Making the decision: How to decide if I want to pursue graduate studies?

I knew I wanted to pursue graduate studies before coming to Midd, but I wasn’t sure what area of research I wanted to go into. I started having conversations with my professors about graduate programs in the first semester of my sophomore year and I took a variety of classes to narrow down my research interests. I love the freedom I have from a liberal arts education and was really grateful that I had the opportunity to get involved in research during an early stage of my undergraduate career; however, thinking about life as a graduate student was still too abstract for me as we don’t have any graduate students on campus. After spending a summer doing research at Middlebury during my sophomore year, I knew that if I wanted to pursue graduate studies, at least I need to be around graduate students and see what it really means to be a graduate student. So I spent my junior summer doing an REU at Berkeley, and it was truly an eye opening experience because for the first time I was able to work with grad students, observe what they do, expand my network, and learn about resources available in a big public university. My experience at Berkeley really had a huge impact on the programs that I ended up applying to, and I was lucky enough to find out that my REU project was the work that I really enjoyed doing. Being part of an amazing community at the Museum of Vertebrate Zoology at Berkeley and having a great relationship with my graduate student mentor really solidified my desire to pursue a PhD.

The hardest part of the process is always deciding **whether you want to pursue a graduate degree, what program is the best fit, and when to start.** I had a lot of really helpful conversations with grad students and Midd alumni about whether doing a master or taking gap years would be the right choice before starting a PhD.

Some common themes that I have found from my conversations were that **reasons behind taking gap years** were often: 1) wanting to take a break before starting grad school, 2) wanting to get some real life working experience; 3) not really sure about what to do or not sure about research interest and wanted to get some lab/research experience; 4) hoping to be financially independent before grad school, etc. Taking gap years would be really helpful and can help establish useful connections, and the only tradeoff is time. NIH usually funds a lot of post-bac programs, and it's pretty common for students to work as a lab technician or lab manager during their gap years.

While a lot of students that I've talked to really recommended that I take time off before grad school, a lot of professors I've talked to actually **discouraged** me from doing a master's degree. A lot of professional masters require tuition, and you should not be doing a master's if it is not funded. If doing a master's is the right fit, it is often easy to find fully funded master programs from state universities that do not have a doctoral program (Cal States); master programs in Canada are usually funded; UMichigan also has a fully funded master program specifically for EEB. If you plan to pursue a PhD, it's also important to note that some labs/PIs might specifically only recruit PhD students who have work experiences or already have a master's degree, though they are not too common.

Before deciding whether, where and when to pursue graduate studies, it is often useful to reflect on your own career goals and why you want to pursue a graduate degree. A research master's degree might be useful for launching a job in governmental agencies. A PhD might be suitable for a career in research and you will get a stipend as a graduate student. For me, having a continuation in my education is a big deciding factor and made me want to do a PhD right after undergrad. By the time when I was applying to PhD programs during my senior year, I felt that I was ready to continue working on my own project.

Here are some great resources from Duke for deciding between a master vs. a PhD: **https://gradschool.duke.edu/admissions/how-choose-right-graduate-school/should-i-pursue-masters-or-phd/**

Types of Programs

There are generally two types of PhD programs in Biology: 1) **umbrella programs** and 2) **direct admit** programs. For general Biological Sciences, Cell Molecular Biology and other related programs, students usually apply to the "department/program", where applicants can have multiple faculty of interest and they do not need to decide on a lab when they first apply. Students will usually spend their first year doing rotations in different labs in the program and decide on which lab to join by the end of their rotation. For Ecology and Evolutionary Biology, it is more common to have a direct admit-type admission. Students usually apply to a specific lab and will join the lab of their choice once they've been admitted. Thus, it is very important to learn about the lab and the PI before making a decision and to make sure that the lab is a good fit.

Preparing for grad school – building a competitive application throughout undergrad:

Duke has a really nice timeline for preparing for grad school as an undergrad:
The process of strengthening your graduate school application starts while you are still an undergraduate. Here is a timeline and suggestions for avenues to explore while you are pursuing your undergraduate degree.

FRESHMAN AND SOPHOMORE YEARS

- Assess your interests, abilities, and career goals
- Identify a mentor
- Look into graduate school preparation events (e.g., boot camps, pre-application campus visits, summer programs)

JUNIOR YEAR

- Gather information on graduate programs
- Gather application materials
- Learn about entrance examination requirements and dates
- Investigate application deadlines

PRE-SENIOR SUMMER

- Narrow your list of graduate schools
- Investigate funding sources
- Write the first draft of your statement of purpose
- Contact recommendation sources

SENIOR YEAR (START EARLY)

- Select the schools you want to apply to
- Register for entrance exams
- Submit completed applications

I believe that two key factors crucial to a prosperous application are **a strong motivation towards research** and **a commitment to making meaningful contributions** through service, such as community engagement, diversity, equity, and inclusion.

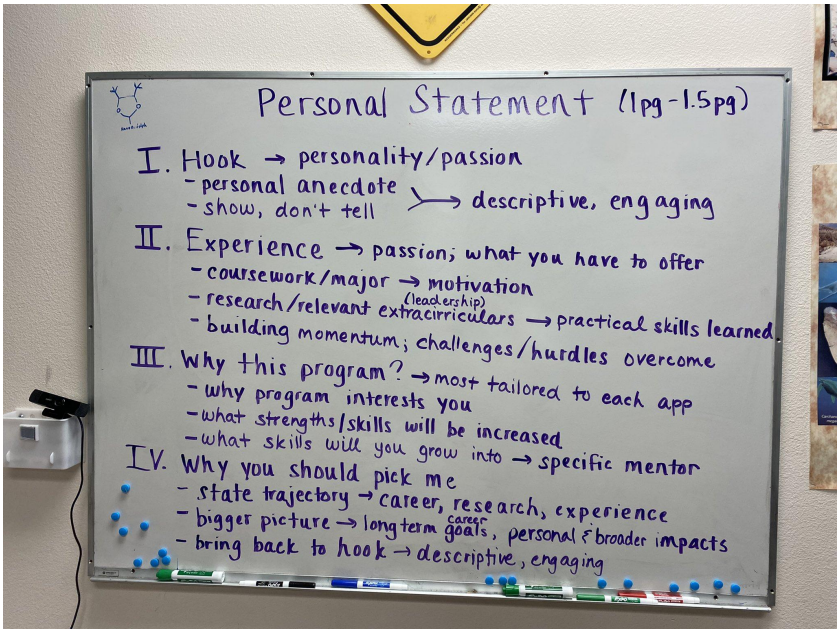
1. Having prior research experiences is really important when it comes to a successful application since a PhD primarily revolves around research. Having exposure to different research projects would also allow you to determine whether doing research is a good fit for you and what research area you want to pursue.
2. A successful PhD applicant should be able to work well in a team since research is all about collaboration. Showing prior commitment to teamwork, contributing to diversity and inclusion efforts through community service and other activities will demonstrate strong potential to work well in a research team. Having TA experiences will also be helpful in demonstrating effective communication skills, a commitment to teaching and mentorship. Students were often required to teach as Teaching Assistants in most EEB programs.

Getting involved in research at Middlebury

Middlebury (and the Biology department) has amazing faculty and great resources for research. Highly recommend reaching out to faculty members about your interest in their research during the early stages of your undergraduate journey by chatting with them during office hours. Focus on what you can learn from your research projects and demonstrate growth in your research abilities. It's common for students to first work on an existing project as a research assistant and transition to designing their own independent research projects. I think at this stage (as an undergraduate student), **do not focus too much on the outcome of the project**, rather, focus on **what you can learn from the process** and how you will improve on your methods. I really loved getting exposed to a variety of research methods and tools during my undergraduate research, and learning something new was always a goal of mine when I started a new project, even though they might not always produce the most desirable results.

Getting involved in research outside of Middlebury:
Having a summer research experience outside of Middlebury has been truly impactful for me and really allowed me to solidify a goal to pursue a PhD. I highly recommend applying to external programs such as the NSF-REU, as they usually provide resources, workshops, and just very strong connections for preparing a competitive PhD application. Here are some examples of external programs supporting undergraduate research. I think cold emailing professors from other institutions is also a really good strategy to get a research position.

1. National Science Foundation Research Experiences for Undergraduates (NSF-REU)
   *Note that REUs are extremely competitive, many usually select only 10-12 applicants from a pool of up to 400-500 applications. There is no application fee, so highly recommend applying to a wide range of programs (>10 is usually a good number) and the format of an REU closely follows a grad school application.
   - Tips for writing a compelling personal statement for an REU from Jackie Galvez, PhD candidate at UC Berkeley:



2. The Leadership Alliance

3. Amgen Scholars Program
4. Institution-specific summer research programs that are open to all students:
    a. UCI SURP
    b. UC Berkeley IB SURE (open to graduating seniors)
    c. NYU SURP
    d. MORE: https://www.pathwaystoscience.org/Undergrads.aspx
5. Cold emailing professors in other institutions and get CCI to fund for your research experience

Tips:

If you are doing an external internship/research at an outside institution that you are interested in pursuing graduate study in:

- If possible, schedule **in-person** meetings with potential PIs that you are interested in working with while you are there and ask about potential opportunities!
- Talk to current graduate students in the lab(s) and the department (cold-emailing students to schedule in-person meetings).
- Usually fun to do a search to see if there are any Midd alumni who are currently graduate students in the institution and set up meetings with them. They would usually tell you everything about their experiences.

PhD application timeline - EEB programs

Because most EEB PhD programs are direct admit programs, it is important for you to identify labs that you are interested in and reach out to the PIs in advance to inquire about whether they are taking any incoming graduate students in the next cycle. You should only apply to a lab if the PI is planning to accept students into their lab, or your application will likely not be considered. Because PhD applications are often very specific, it is common to apply to a range of 4-8 programs.

Helpful link for grad school app in EEB:
https://www.mordecailab.com/blog/applying-for-grad-school

Getting started:

1. Search for programs/institutions you're interested in
    - Mentors can give you suggestions of programs
    - Where you decide to apply is personal and is based on what's important to you
    - Some websites post funded EEB PhD positions but can be more competitive than normal application process:
        - EvolDir
        - ESA
        - TAMU Job Board
2. Look at the requirements for each program

3. Identify faculty in the programs that you are interested in. Make sure there are more than one faculty you could see yourself working with if you are applying to a rotation program. When considering what labs to apply to, consider:
    - Lab culture, size of the lab
    - Whether you want to work with junior faculty or more established faculty
    - Mentorship style- whether you want to work with a more hands-on or hands-off PI
4. Once you've identified all programs and labs that you are interested in, send out inquiry emails to the PIs.They will tell you if they are taking any student in the upcoming cycle, and if they are, they will likely schedule Zoom meetings with you to chat about mutual interests. These can be considered "informal interviews" and are really great opportunities for you to learn more about their research. You will be invited to formally apply if they think you would be a good candidate. Send a follow up email if they do not respond to your inquiry email. Professors are really busy and do not have time to respond to every email- maybe send up to two follow-up emails if they do not respond.

*I think people have different opinions on this, but I would recommend reaching out to graduate students of the labs that are on the top of your list before formally submitting an application, especially if you are really interested in working with a certain PI. Ask about their mentorship style, lab culture, and how it is like to be a graduate student in the lab/program. Having these conversations early on can prevent situations when you might be disappointed after you finally meet the PI during an interview but find out that they might not be the best PI to work with.

Components of a PhD application

- **Statement of Purpose**
    - Usually ask about your past research experience and what you want to pursue in your PhD:

Prompt example: Specifying your area of interest, outlining your qualifications and experience in this area and associated career goals, and indicating whether you wish to be considered for a teaching assistantship (if so, please describe any previous teaching experience). You should also indicate the faculty member (s) with whom you have been in contact and list them in order of your preference as your possible advisor.

*Try not to list all the techniques you have learned. Instead, focus on what questions you asked, how you addressed them experimentally or analytically, and how your findings fit into the broader knowledge base of the field. Discuss experiences when your experiments worked as well as times when your experiments failed what you have learned.

*You should include names of the PIs that you are applying to work with in your statement and explain why you are interested in their work, and connect your own interests to their work. Each of your application should be tailored to the specific program

- **Diversity statement/personal statement**
    - Usually an opportunity for you to explain more about your personal backgrounds, how you have contributed to diversity and inclusion, also provides opportunities for you to describe any obstacles or challenges you have faced.
    - Tell about **who you are** as a person and how your personal background and experiences shape your desire to pursue graduate education
    - If you have experienced challenges in your life and/or undergraduate career, you can talk about them here. Make sure to highlight how you have overcome those challenges, what have you learned from these experiences, etc.
    - You can include extracurricular activities that speak to your values, leadership, and other skills that are relevant

*make sure to get feedback from your professors, friends, mentors for all of your statements

- **(3) or more letters of recommendation**

Tips:

Letters of recommendation should come from professors/supervisors who know you well:

- Highly recommend getting letters from every research advisor that you've worked with who can speak well about your research abilities. If you do not have a letter from someone who you've done research with, some suggest that you should explain why.
- Directly ask for ***strong*** letters of recommendation.

- Standardized Test Scores (GRE): no longer required for EEB PhD programs
- Grades/unofficial transcripts
- Research/Work Experience
- Funding

Here are some programs that support PhD applicants and help develop competitive applications (EEB and not EEB):

- Consider Cornell
- Berkeley's PhD Bootcamp
- Princeton's EEB Scholars Program
- UC Davis's E&E Grad School Preview Program

Below is a timeline that I've created for my own application:

Pre-Senior Summer

June - July

- Research graduate programs and narrow down a list of PIs that I was interested in working with
- Finish the first draft of personal statement for fellowship application
- Identify three recommenders for my applications
- Have conversations with graduate students to learn about tips for grad school application

August - October

- Send out requests for letters of recommendation
- Finalize a list of graduate programs
- Start cold emailing PIs and set up Zoom meetings with them to discuss about research projects in the lab and potential opportunities
    - Cross out labs/programs that are not taking students and add in new ones
- Start drafting all statements for grad applications
- Late October: Submit GRFP application

December

- Finalize all statements and submit completed applications

January - March

- Receive virtual and in-person interview invitations
- Decisions were made after interview events (usually within two weeks)

April

- GRFP decision release
- Grad program commitment deadline on April 15

Fellowship Application

- Fellowships provide a stipend to pay for your living expenses, might cover tuition and fees, can include funds to buy materials or provide professional opportunities
- Can come from federal, institutional, private institutions, etc. and are usually very competitive

1. The National Science Foundation Graduate Research Fellowship (NSF-GRFP)
    - Applications open late July/early August and close in October (deadline date is based on discipline)
    - Can apply both before and after starting grad school (you are allowed to apply multiple times before starting grad school; however, once you started a PhD, you can only apply to the GRFP once either in your first or second year)
        - The GRFP **mainly funds the person** not the project, it's nice if you can develop a research proposal with your potential PI.
        - Focus on broader impacts not just the research in both the personal statement and research proposal
        - You will get all the comments from the reviewers on your application after the decisions are released, which I thought were pretty helpful to have.

2. Ford Foundation Fellowship

4. Some schools might allow you to apply for their internal fellowships on their application, and others might nominate applicants for certain fellowship opportunities.

Tips:
Highly recommend scheduling a meeting with **Lisa Gates**, Associate Dean for Fellowships and Research - she has a lot of really valuable resources to share and she is amazing! **Hannah Benz** from the CCI is also really amazing in helping with STEM grad school applications.

After submitting your application - Interviews and recruiting events

After submitting your applications, you can expect to hear back from the programs from early January to late March about your application status and whether you are invited to an interview. Most interview events are in person, and the program will pay for all the expenses. You will meet your potential PI and labmates and have conversations with them.

- Interviews are fun! They are really opportunities for YOU to meet people from the department and to determine whether the program is a good fit for YOU. You will also meet your cohort and the people who you will potentially be "classmates" with. Take advantage of every opportunity to learn about the department and the lab(s) that you are interested in - imagine that some very famous professors would devote their time JUST talking to you! Also exchange contact information with your peers, this would be really helpful when you are looking for roommates after you commit to a program.
- Although getting interviews does not guarantee admission, it is quite common that applicants are ranked prior to the interviews (and you are ranked pretty high if you get an interview!), so they are really just great opportunities for everyone to see whether it's a mutual good fit.
- Learn about the faculty's research. You will likely be asked to rank multiple professors in the department that you want to interview with, and you might not be interested in working with all of them. Make sure to read over their research interests/statements/abstracts of research papers so that you can be engaged in good conversations- show enthusiasm!
- You might not like everyone who you've interviewed with and that's totally ok. Don't take it personal and focus on conversations that you enjoyed.
- Talk about research experiences that you are most comfortable with explaining to others (who might not be experts in your field). Focus on what you've learned from those experiences and how you will apply those skills in grad school.
- Ask a lot of questions! Ask the grad students about the mentorship styles of the PIs, lab culture, and everything you wanted to know to assess whether the lab is a good fit for you. Also important to consider cost of living, work-life balance, stipend, how much you have to TA, etc.
- Even if you don't see yourself in a certain program/school, ask about general grad school advice or just ask about people's research - you will be surprised by how much you can learn from an interview!
- Send thank you notes after you are done can leave really good impressions.

Choosing a program

This is the most exciting part of the application process! Obviously choosing a program can be very stressful. I think the most important factors to consider are really **the fit of the lab** and **whether you see yourself as a graduate student in the program** because you will spend the next five to six years there. I made my decision because I thought I had really great conversations with my potential PI when I was visiting the lab, and I really believe my PI's mentorship style is what I have been looking for. And the lab is really well-funded. I had great conversations with the graduate students and postdocs in the lab and I can also see myself working well with them. Other big decisive factors for me include the location of the school, the supportive and collaborative culture of the department and I could see myself having great relationships with a lot of other professors in the department. Funding and stipend are also important factors to consider when choosing a program.

*One recommendation is to really listen to the grad students- they are the ones who spend their time working with the PI and everything they told you is likely to be true. If you feel something is weird, it is probably weird and do not try to find an excuse for it.

*More resources can be found on Duke's website here: https://gradschool.duke.edu/admissions/how-choose-right-graduate-school/how-prepare-strong-graduate-school-application/