Nu Rho Psi Presents

GRADUATE SCHOOL IN NEUROSCIENCE: A "How-To" Guide for the Application Process and What to Expect in Graduate School

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INTRODUCTION:

The choice to go to graduate school is an exciting passage in life, but it is also a major decision that is best approached with the facts in hand. That is why Nu Rho Psi has created this "guide book" to help elucidate the application process and shed some light on what to expect in graduate school. While this Guide specifically refers to neuroscience graduate education, most of what is contained can apply to any life sciences graduate program, including M.D./Ph.D. options.

This purpose of this Guide is *not* to tell you which research institution to choose or to tell you *exactly* what to expect from any given application, program, advisor, or research project. Every process is slightly different, and every applicant has different needs and goals. Rather, this Guide is meant to provide you with the basic information that will help you make an informed and confident decision for yourself. It also includes information regarding how to compose a *curriculum vitae*, external funding opportunities, career options, and much more.

What you will notice as you read through this document is that graduate school represents a very individualized experience. There are not always common entrance requirements between programs, uniform courses of study, or similar research experiences. That is why it is so important to find the best fit for *you*! We hope this Guide will help you as you begin this exciting process.

Best of luck!

-- Zoe Hesp, PhD

Part 1: **Application Process Timeline**

GENERAL INFORMATION:

You may be asking yourself:

"It's great that I have this Guide, but what *is* graduate school exactly and *why* would I want to go?"

Great question! In short, graduate school is a research-based educational program that will typically result in your receipt of a Ph.D. degree in Neuroscience (and/or an M.S.). Not only will you gain a deeper understanding of neuroscience, but, most importantly, you will learn and take part in the research process by which the facts in your textbooks were discovered.

Graduate school in neuroscience is not only usually ***FREE*** but many graduate departments will also provide you with a living ***STIPEND*** (more on this in following sections). How can it get better than that?

WHEN TO APPLY:

First, not all students begin graduate school immediately after receiving their undergraduate degree. In fact, according to a 2013 survey that Nu Rho Psi conducted of its membership, about 25% of undergraduates intend to take a year off before entering graduate school. You will find that, perhaps in contrast to medical school, many current graduate students worked as research technicians or held internships/other full-time professional jobs before applying to graduate school. If you feel you need to build your research resume or just aren't quite sure that research is for you, then working full-time in a lab is a common alternative. Other undergraduate students have found it very challenging to both apply to graduate school and simultaneously keep up with their studies. So you may decide to spend the year after you receive your bachelor's degree selecting the right graduate programs for you and preparing your applications. But when you are ready to apply, here is the general timeline you will need to follow:

GENERAL APPLICATION TIMELINE:

Not later than the summer before graduate school (e.g. between junior and senior year of undergraduate education):

Start narrowing down school selections (for resources to identify programs, see below in Part 4); review applications and requirements; prepare for/take the GRE/MCAT.

September-November:

Start the application process; identify potential letter writers and request letters of recommendation from professors or others you know well in a professional setting; make sure to have taken the general GRE (or sometimes MCAT) (See below).

December-February:

Applications due! Sometimes these are rolling (see below). You will need: undergraduate transcript, letters of recommendation, *curriculum vitae*, and personal statement.

January-March:

Interviews

April 15:

Common national deadline for graduate school decision. Some schools will accept students beyond this date, especially if open spots remain.

WHERE TO APPLY:

Narrowing down your list of schools (or simply finding more to add to your list) is by far the most challenging aspect. Applications can cost alot of money, and some students 'over apply' and are not able to attend all of the interview weekends. Also, what every student is seeking in a school varies greatly. In addition to choosing a specific program, it is also important to consider your potential quality of life in an area and to think about how you will enjoy living in a city when you are not in the lab.

Two general rules-of-thumb you may want to consider when compiling your initial list of schools are: (1) *It is not the school that makes your graduate experience, but rather your advisor* and (2) *The greater the pressure to obtain more funding, the greater the pressure to publish (or perish)*. To address the first point: yes, it cannot be denied that reputation of a school counts for something; but two students entering into the same program in the same year can have both the best and the worst experiences of their life, depending on whose lab they choose. Of course, no student has one specific advisor they have arranged to work under for each school they apply to – that is what lab rotations are for (see "Interviews" and "Lab Rotations" below) – but there are resources available for students to do some investigating before applying (see below). There are both big fish and little fish at every program, and the most 'well-known' scientists in certain fields are not always at the most 'well-known' schools. And that also does not guarantee that they will be the most excellent advisors. As for the second point, the most 'prestigious' labs or programs do also tend to be the most competitive, which means publishing and seeking funding more often. This is what many students want – but it also means more pressure and fewer opportunities to be involved in other activities like teaching.

Below are some questions that you should definitely ask yourself and seek the answers to before sending off an application to any program:

School-specific questions:

1) Is this a city/area I would be satisfied to live in?
2) Is the stipend sufficient for the cost-of-living?
3) Is the size of the school/program what I am looking for?

Research-specific:

1) Are there (multiple) professors' research I am interested in?
2) Are these professors actively taking students?
3) Are these professors currently funded?

When trying to research specific professors, you will find that program webpages about current faculty are often out-of-date and that past publications of a potential advisor are not necessarily indicative of their future direction or funding status. One of the best resources available to discover what professors are currently funded for (and how much) is the NIH RePORTER. NSF also has a similar awards search system here. The NIH RePORTER allows you to search for current and past NIH grants by awardee name, institution, department, fiscal year, etc. This is one of the easiest way to find out what a professor is currently funded to research, how long until they must re-apply for a grant, and for how long they have renewed the same grant. The NSF award search also allows you to look-up grants by topic.

Again, once you enter a program your world will become your specific lab, not necessarily the institution you applied to. Perhaps the better question is not *where* to apply, but rather *to whom*.

UNDERGRADUATE REQUIREMENTS:

While there are always exceptions to the rule, generally a student must have *some* research experience prior to applying for graduate school. This is absolutely crucial, especially when applying to a Ph.D. program. However, this previous research experience does *not* have to be related to what you may want to study in graduate school. It is not necessarily expected that a student will continue the same work as they did in undergraduate. In fact, graduate faculty may well expect that their new students will be working on research topics that are closely related to the ongoing work in their labs.

Also, the undergraduate course requirements that qualify a student for graduate study may be rigorous but are not as rigid as those for medical school. Some graduate programs will not even list course requirements because what a student would like to pursue in graduate school can vary widely in neuroscience, and thus educational backgrounds will also vary. While most students do enter a neuroscience graduate program with a major in a life sciences-related field, a student interested in computational neuroscience may apply with a major in mathematics, for example.

One misconception is that you will not be competitive for a neuroscience graduate degree if you have not taken extensive neuroscience classes or that you did not major in neuroscience. While having a neuroscience major is very helpful, it is by no means mandatory. Graduate programs realize that neuroscience is a relatively 'young' field of study and that the vast majority of undergraduate programs do not offer a neuroscience major/minor or other intensive neuroscience classes. Obviously, you should educate yourself about neuroscience as much as you can before you make the decision to enter a neuroscience graduate program; however, all entering students in graduate school will still take all of the same basic neuroscience classes to assure a similar foundational level of knowledge.

What about being 'published'? The vast majority of graduate programs do *not* expect you to apply with any papers published, let alone as a first-author, and especially if you are a senior undergraduate with only two years of lab experience. The students who do apply with publications under their belt are the very small minority. Of course, if you do have a publication, it is a great enhancement to your application as it is a testament to your research involvement and knowledge about the importance of research dissemination; however, a rule of thumb is that being published can only *help*, but not hurt, your application. Presentation of your research at the Society for Neuroscience meeting (http://www.sfn.org/) Faculty for Undergraduate Neuroscience (FUN) poster session, or at regional neuroscience meetings (NEURON, mGluRs, SYNAPSE, MidBrains, etc.) will also provide some credentials respected by graduate schools. Your letters of recommendation should address your research involvement even if you do not have any publications.

One rule of thumb is that most programs will require at least a GPA of 3.0 (out of 4.0). This is not set in stone, and students who have lower than this can still be competitive in some graduate programs if the rest of your application is very strong. If you have lower than a 3.0 GPA, it is recommended that you address this in your personal statement (see below). For example, if you entered your undergraduate training 'unprepared' and received poor grades in the beginning, but then improved your academic performed and raised your GPA over time, you should explain this in detail and ask your recommenders to do this too.

THE GRE (Graduate Record Examination):

The vast majority of graduate programs will require that you take the GRE and have these scores ready for their review during application. The GRE is analogous to the SAT or ACT exams that you would have taken for undergraduate admissions. The GRE is typically taken on a computer (although some sites still offer paper-based exams), but because of this there are multiple testing dates throughout each month. (GRE registration website: http://www.ets.org/gre/revised_general/register). It costs about $200, and the exam consists of verbal reasoning, quantitative reasoning, and analytical writing sections. The GRE should be taken at least one month before applying to graduate school in order to secure your official scores.

How important are your GRE scores for acceptance? Of course, the answer to this question is different for every program, but usually you can obtain the scores earned by the average admitted student from the institutions where you are applying. Keep in mind, however, that your letters of recommendation, research experience, and personal statement are the most telling aspects of your true capabilities and will have the most impact overall; therefore, an applicant who is lacking in these other areas will probably *not* be 'rescued' by perfect GRE scores.

There are GRE Subject exams in Biology, Psychology, and other sciences. The vast majority of schools will report that subject tests are "recommended, but not required." They are only offered three times a year at certain paper-based test centers. It is best to talk to individual graduate program admissions to see how many entering students do actually take these exams and if they are required.

Finally, there are a handful of schools in the US that do not require GRE scores or *may* waive this requirement if you have had extensive previous job experience or for other atypical circumstances. These schools only comprise about 1-2% of graduate programs, however. Sometimes schools will also accept Medical College Admission Test (MCAT) scores in place of GRE scores, especially if you are applying to a dual M.D./Ph.D. program.

LETTERS OF RECOMMENDATION:

Your letters of recommendation are as important as your previous research experience and science education, for they are the objective testaments to what you may write in a personal statement or in your *curriculum vitae*. Your research advisor should always write one of your letters. (If for some reason you do not ask your research advisor to write you a letter, it is advised

that you contact the program you are applying to and explain why this is so.) A second good choice is another professor from of your neuroscience-related classes that can discuss your role as a student independent from your work in a research lab.

It is recommended that you give your letter writers at least *one month* to write your letter. This is foremost courteous as well as necessary as professors are quite busy. In fact, it is recommended that you ask your professors if they will be willing to write you a letter even 2-3 months before you require it and ask them how long they will require to write a letter for you. Nowadays, most letters of recommendation are submitted electronically by your professors, but in the case where paper letters are still accepted, it is also courteous to provide your letter writers with an envelope that is already properly addressed and stamped.

Even if you have known your letter writers for many years, do not assume that they will remember everything about your achievements off the top of their head. When asking for a letter, it is recommended that you ask your writers if you should provide them with the following information:

- current *curriculum vitae* (see below)
- list of courses you have had with that professor with grades received
- information about special studies/research/projects you have done
- current overall GPA and major GPA
- information about what type of graduate program you are applying to
- information about deadlines for letters
- any other information that would help your professor write a strong letter (sometimes program websites will provide examples of what they would like to see in a letter or specific questions to address)

Don't forget to inform your letter writers of your acceptance to a program or any awards you may receive! Make sure you write your recommenders a "thank you" note. These are folks that you want to have a relationship with for many years to come. Be nice to them!

CURRICULUM VITAE:

You may have heard the acronym "CV" tossed around, but what exactly is a *curriculum vitae* (CV) and how is it different from a standard resume? *Curriculum vitae* is a Latin word that means "the course of life" or "life's work," and in short is a scientist-specific resume. It contains most of what a regular resume does, with the addition of your publications, posters/presentations, and history of faculty positions, research positions, professional organization membership (like Society for Neuroscience or Nu Rho Psi), etc. One difference between a resume and a CV is that a CV is expected to be a complete record of your professional experiences, not a shortened version of them. A full professor's CV may be many, many pages in length. Any of your professors can help you and give you advice in crafting your CV. This is where you should emphasize your research experience and any conferences you may have attended. Some applications may have a separate form where you list your "extracurricular" activities, and therefore you may not need to include these on your CV. When you ask your professors for a letter of recommendation, be sure to give them a copy of your CV to help them in crafting their statement. Some examples of medical/science CVs can found at this website from UW Medicine.

When applying to graduate school, as well as to other future academic positions, you will want to submit a traditional CV. If you ever apply for a job in industry, you will want an "industry CV," which is often shorter and more tailored to a specific job. For more information regarding CV's vs. resumes, take a look here.

THE PERSONAL STATEMENT:

Sometimes admissions websites will provide prompts for you to address in your personal statement, but often this space is open for you to write about anything you like. You should *not* however simply repeat what is already written in your CV and nothing more. These statements can definitely be the deciding factor in whether or not you are offered an interview if all else is equal. Because graduate school is such an individualized journey, your personal statement is truly meaningful and the opportunity for you to express your unique experiences that will contribute to your being a successful scientist.

Some examples of what you may want to discuss in your statement include:

- unique research experiences, stories of accomplishment/critical thinking that are beyond what is conveyed in your CV
- your enthusiasm and motivations for going to graduate school
- involvement in science beyond the lab (i.e. educational volunteerism, leadership roles)
- long-term career goals
- address any weaker points of your application such as GPA
- other job experiences that would contribute to your success as a scientist
- your research areas of interest
- identify specific professors that you are interested in working with

Remember to tailor your personal statement for *each* graduate program you apply to. Some programs may ask you to identify specific professors you are interested in working with (especially at smaller schools that do not have rotation requirements). But note: if a program requires/offers lab rotation in a student's first year, it is *not* expected that you know *exactly* who you want to work with as your research advisor before you enter. However, even if an application does not specifically ask you to identify potential research advisors, it is usually beneficial to do so. If there is a specific professor you are interested in working with, then it is often encouraged that you make contact with these faculty beforehand and open a dialogue with them so that they can be on the lookout for your application.

APPLICATION DEADLINES:

Many programs have an 'absolute' due date for applications; however, some programs do have rolling admissions where students who apply before a specific date will be given preference, but admissions will still remain open after that time.

DUAL MD/PhD GRADUATE PROGRAMS:

Many schools with an associated medical school will offer a dual M.D./Ph.D. program in which a student will alternate between a medical school curriculum and graduate-level research. These programs are about 8 years long, but your medical school education will likely be *FREE* and you will be provided a stipend throughout all of your years in the program. Traditionally a student would apply to both the university's medical school *and* graduate school separately, be accepted by both, and only then will he or she be subsequently considered for the M.D./Ph.D. program. Currently, more and more universities have students apply directly to a specific M.D./Ph.D. program where they are evaluated by a specific M.D./Ph.D. committee. In these cases the MCAT will often (but not always) be accepted in place of the GRE for graduate school. Students in an M.D./Ph.D. program will usually do research rotations the summer prior to and also in between the first and second years of medical school.

INTERVIEWS:

Interviews are as much about a school interviewing you as it is about you interviewing the school. Typically, interviews will require you to spend two nights, and all travel expenses are usually paid by the school. Interviews usually take place on a Thursday through Saturday. Make sure to inform your undergraduate instructors ahead a time of your planned absence in order to sort out exams or assignments, and don't be surprised if you are asked to provide proof of your travel, especially in classes with attendance requirements.

A typical interview schedule will consist of the following:

- 2-4 individual meetings with professors (these are the 'interviews,' but you may also have a panel-interview session)
- presentations about the program and requirements
- facility and lab tours
- research presentations by faculty
- lunches and dinners with student and/or faculty
- social time with current graduate students
- poster session
- tour of the city

Expect interviews to be rather exhausting, as you will be walking the vast majority of the time with very little down time, even in the evenings. Attire is usually business casual. Beyond the time you spend with current faculty, you will have time to interact with the current graduate students as well. These times are extremely important opportunities. *Ask the current students what they think of the program!* Interactions with the other students will provide you with the most objective perspective of what your life will be like there. Find out their opinions about professors, research, facilities, classes, and most importantly, how they are treated and what their life is like in the place in which they live. It is even a good time to inquire about housing options and how 'affordable' a location is to live in. Current students will be honest with you in their opinions of their program.

How can you prepare for the interview weekend? Prior to receiving your interview schedule, most schools will ask you to provide them with a list of professors that you would like to meet with. You will most likely not get to meet with all of your choices, but if there is

someone in particular you would like to meet that you are not scheduled to do so, usually you can arrange with that professor to meet at some other time during the weekend.

Every interview (or rather, meeting with faculty) will be different, even at the same institution. In fact, most will not even feel like real 'interviews' at all. You *should* be prepared to discuss your own previous research. You should also be familiar and ready to discuss the research of the faculty members who interview you. Some professors may spend all 30-45 minutes talking about their own work, some may give you a tour of their lab, some may ask you about what future research you would be interested in, etc. *Just relax!* It is unlikely that you will be 'grilled' or asked to talk about your work for 30 minutes or necessarily be 'interviewed' in the typical sense that a medical school student may anticipate (although of course there are always exceptions to this). They are often more informal than students expect. Only some of the professors you meet with will actually be on the interview/admission committee at all. And most importantly, be prepared with your own questions to ask! One of these individuals may in fact be your research advisor one day, and usually students pick their first rotation advisor from the faculty that they meet during the interviews. Also, keep in mind that sometimes the admissions committee may ask the opinion of current graduate students that you had interacted with during the interview weekend, so it is important to make a good impression with them as well.

It is true that not all interviewees will be offered acceptance on the first round; however, those that are not initially selected are usually first on the waitlist. You can hear back from a school in as little as two weeks.

Part 2: Graduate School

GENERAL INFORMATION:

Usually your participation in a graduate program begins at the same time as classes start at the university in the fall (or in the spring if you enter a program that has spring admissions). There will be some kind of orientation about a week before classes begin, but it is often recommended that a student move into their new residence up to a month beforehand in order to get to know the new city. Some programs will also offer the option for students to begin their first lab rotation over the summer before classes begin. In this case, you should confirm if you will be paid additionally for this time.

The rest of this Guide will refer specifically to processes associated with a Ph.D. program, as there are only a handful of institutions in the country that offer a Master's degree in Neuroscience. A few programs offer a Master's degree only to those students who are on the way to getting the Ph.D. In these cases, there are typically separate requirements for the Master's degree, and it may be considered a "consolation prize" if advancement to Ph.D. candidacy is not achieved (see below). But more often than not this intermediate degree is skipped all together in a program that results in a Ph.D.

THE STATS:

The Society for Neuroscience regularly publishes a very comprehensive report on "the stats" of neuroscience programs in the USA. While we won't repeat most of those numbers in this Guide, you can find the most recent report from 2010-2011 here. This report includes information on general graduate program characteristics, graduate program faculty, postdoctoral training, program diversity, financial support for trainees, and also undergraduate education. It is a fantastic reference for any "numbers" questions you may have.

FUNDING/TEACHING ASSISTANCE:

As stated before, not only will graduate school be "free" to you, but you will also receive a stipend. What "free" actually means, however, is that an institution will usually still charge you tuition and fees, but these will be paid for or waived in some manner. In some cases, your graduate program will pay for your tuition/fees/health insurance/stipend in your first year concurrent with lab rotations, but after you officially join a lab these costs will be turned over to your advisor. (This is why you will be told that you must first ask if a professor is actively "accepting" students in the lab before considering joining. It costs a lot of money to take on a student in a lab, and this is where the bulk of one's mentor's grant funding goes!). In other cases your tuition and fees may be waived entirely or be covered by the graduate school for your entire time of matriculation (this is more common at smaller schools and for Master's programs). You will usually still be responsible for paying for textbooks and other non-instructional fees.

Your stipend (and other costs, such as health insurance) will usually be provided as compensation for services you provide for the university, either through a full-time research assistantship (RA), a teaching assistantship (TA), or a combination of the two. Being a RA means that your advisor has sufficient funding to pay your stipend (and all other fees/tuition) so

that you can spend all of your time in the lab and not teaching/grading papers. Fellowships can also fund you to be a full-time RA. Such research fellowships may be provided through endowment funds at your university, but many students will be encouraged to apply for extramural fellowships such as the Graduate Research Fellowship (GRF) offered by the National Science Foundation (see more below under "External Funding"). An RA will still generally have a small teaching requirement usually in their 2nd or 3rd year. Being a TA every year means that you will be required to teach or work for the university in some manner to supplement your stipend or to allow the waiver of your tuition. This is extremely common for smaller schools and Master's programs. While teaching does take time away from research, the reality is that usually only large well-funded research institutions can offer their students RAs. Also, being a TA can be ideal for those who desire a career primarily based in teaching. (For my information regarding this career path, see this publication by Dr. Julio Ramirez from the Journal of Undergraduate Neuroscience Education) Typically if you are an RA your advisor will not want to teach beyond what is required (this is time away from research), but there are some cases, even at large institutions, where you can TA beyond what is required to earn extra money.

As an RA, a common question that arises is: What if my research advisor loses funding and can no longer support me? This is why it is very important to make sure that, in such a circumstance, your graduate program will step-in to support you.

Sometimes an institution's Graduate School will also offer fellowships to some of the top-ranking incoming students. Funding from such a fellowship will mean that your graduate program and/or research advisor will not be entirely responsible for paying for you during the award years. In addition, there are several opportunities for external funding in your subsequent years that your advisor may encourage you to apply for as explained in the next section.

EXTERNAL FUNDING/FELLOWSHIPS:

There are a number of national fellowships/awards available that you can apply for throughout your graduate career. Not only do these pay for some/all of your expenses for the duration of the award (tuition, stipend, etc.), but they are also extremely prestigious (not to mention competitive) and some of the best accolades you can have when searching for a post-doctoral position.

Some of the most prominent awards include:

NIH: Ruth L. Kirschstein National Research Service Award (NRSA)
http://grants.nih.gov/training/nrsa.htm
NSF: Graduate Research Fellowship Program (GRFP)
http://www.nsfgrfp.org/
HHMI: Med Into Grad Initiative
http://www.hhmi.org/grants/office/graduate/
DoD: The National Defense Science and Engineering Graduate (NDSEG) Fellowships
http://ndseg.asee.org/

… but there are many, many more external grants and funding opportunities available as well. *Science* has compiled a good comprehensive list here:
http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2005_11_04/nodoi.11489213157540852751
There are also many formal databases you can search in as well:
http://sciencecareers.sciencemag.org/funding

GENERAL TIMELINE OF GRADUATE SCHOOL (for Ph.D.):
Year 1: Take required classes; lab rotations
Year 2: Finish classes; choose a research advisor; TA
Year 3: Candidacy; TA
Year 4-5: full time dissertation research; defense

According to the Society of Neuroscience, the national average graduation time from a Ph.D. program in Neuroscience is 5.5 years. A Master's program lasts on average about 2 years and does not usually include lab rotations (you will begin your thesis research immediately). Often Master's students will be required to TA every semester/quarter in order to supplement their stipend.

LAB ROTATIONS:
Many Ph.D. programs will have lab rotations built into your first-year schedule. What this means for you is that: (a) it is not necessary for you to have an advisor officially identified before you enter the program; (b) you will have the opportunity to explore many different research interest areas; and (c) you will get to 'test-drive' a lab and an advisor before you commit. You will need to have your first rotation arranged before you begin a program. (Note: Master's programs usually do not offer rotation opportunities due to time constraints).

You will usually have the opportunity to do up to 3 lab rotations over the course of a year and possibly even begin this process the summer before classes begin. The expectations of every rotation advisor are different. You will most likely be paired with another graduate or post-doctoral student and help them on a smaller aspect of a project, learning the techniques and knowledge of that lab.

Some students do begin graduate school already having identified their desired research advisor (and knowing that that advisor is willing to take them.) While you may be able to commit to a lab early and not complete a whole year of lab rotations, it is often advised that you still take advantage of the opportunity to do a rotation in at least one other lab. You will have the opportunity to learn new research techniques, network and perhaps find a lab you actually like better.

CLASSES:
All graduate programs will have a set of required "core" classes that span 1-2 years. These classes aim to give all entering students the same fundamental knowledge of neuroscience

and are in place because the level of neuroscience education offered at undergraduate universities is extremely varied. Of course, you should have some baseline knowledge of neuroscience before you begin your graduate career. However, don't worry if you haven't taken an intensive neuroanatomy or neurophysiology class before – that is the purpose of these "core" classes. Some programs will have a uniform curriculum you must complete with the option of 1-2 electives, while others may let you select your classes that fall into specific 'categories' (such as molecular neuroscience, cognitive neuroscience, etc.) It is usually up to your research advisor to recommend how many extra elective classes you can take, for they may not want you to spend too much time outside of the lab. Most programs now also require students to take a "research ethics" course at some point in their graduate career.

CANDIDACY:

Contrary to the belief of most entering students, you are not actually considered to be an official Ph.D. candidate until around your third year when you pass your 'candidacy exam.' Candidacy typically refers to both an oral 'exam' and some kind of written research proposal that your candidacy committee will review and determine if you have the capabilities to continue successfully and have sufficiently developed as a scientist at this point in your graduate career. Although most students take their candidacy exam anytime from the end of their 2nd year through their 3rd year, your advisor will most likely not encourage you to begin the process until they perceive that you are ready.

Yes, candidacy is a big deal. It is usually considered much harder than your final thesis defense. The 'oral exam' generally consists of a presentation of your previous and future planned work, followed by open questioning by your committee who can ask anything relating to your research or, truthfully, anything they want. While it does depend on the program/institution, the candidacy exams *are* usually intended to make you 'sweat' and to reveal what you do not yet know. The written portion of your candidacy is generally a research proposal relating to either your future planned work, something entirely different from what you know, or both.

Keep in mind that the vast majority of students *do* pass their candidacy, and those that were not as strong of candidates can even be asked to re-present or given another chance to improve their proposal. However, this is the point in your Ph.D. when you can be asked to leave if you truly are not prepared. To help you in this process, you will have a candidacy committee that you meet with multiple times before your actual candidacy and who will give you feedback and advice. This committee will include your research advisor as well.

When it comes to choosing and working with your doctoral committee, almost all of the onus is on the student who must truly "manage" their committee members. In addition to your research advisor, you should select committee members who are not only knowledgeable in your area of research, but also those who you can rely on to perform their expected duties both expertly and on time (i.e. showing up to your meetings and sending feedback on time). The student must arrange all of the meetings, disseminate drafts to the members, and follow up with them to assure all proceeds as planned. If a student runs into a problem with their committee, their program will typically have designated program advisors or an advocacy group in place to help a student along and work out any roadblocks.

DEFENSE:

Briefly, your defense is scheduled on the day when it will be decided if you are to be awarded a Ph.D. It generally consists of an oral presentation to a large audience as well as a private oral "defense" of your dissertation that you have already written and that has been read by your defense committee. Your dissertation (or 'thesis' for a Master's) is a very large document that essentially explains everything you have researched in graduate school, generally tying together all of your publications and the over-arching research hypothesis you have been using your entire time. Usually one's defense does not at all have the same kind of pressure as one's candidacy exam. Rarely people fail their defense, and your mentor will ultimately determine when you are ready. Unlike during your candidacy, at your defense you are expected to be an 'expert' and know everything about your thesis that you have just completed writing, as you have personally done all of the research on it. If you are not an expert on your primary research question, then you probably will not find yourself defending until you are. You can think of your defense fundamentally as a capstone of your graduate experience. While you certainly should practice your speech as much as possible and prepare for questions by your defense committee, at this point you should be confidant in your abilities as a researcher and not concerned that you will be unprepared to discuss your research at any length. Of course, after you do successfully defend and are awarded a Ph.D., almost all students still continue to work in their lab for some period of time, completing projects and waiting for their next job or post-doctoral position to begin.

Part 3: **Careers in Neuroscience**

One question you will repeatedly be asked by both others and probably yourself is: So what can I do with a Ph.D. in Neuroscience? Many graduate students assume this means a career in academia, but there are many other possibilities, some of which we will list here. Most "career alternatives" are not necessarily "neuroscience-specific" so much as "Ph.D.-specific." As mentioned previously (Part 1, *"Curriculum Vitae"*), there is also a difference between an "academic CV" and an "industry CV." But first, let's look at the hard numbers:

(Taken from *Report of Survey of Neuroscience Graduate, Postdoctoral, & Undergraduate Programs [Academic Year 2010-2011]*, written by Alan F. Sved, Ph.D., University of Pittsburgh):

"Upon receiving their PhD degree, most graduates pursued further research training and accepted postdoctoral positions (65%); this was especially true of non-U.S. citizens (73% vs. 62% of U.S. citizens). The majority of the rest of the graduates returned to medical school or began a medical internship or residency (15%), consistent with the proportion of M.D./Ph.D. students. Relatively few moved directly to faculty positions (5%) or jobs in industry (5%). As in previous years, very few graduates were not yet employed (2%) or none were employed outside of neuroscience. The percentage of graduates who were women (50%), U.S. citizens (77%), members of U.S. minorities (12% of U.S. total), or Asian-Americans (12% of U.S. total) were comparable to their numbers among graduate students. Within different subgroupings, post-graduation placements varied slightly."

Note that the above statistics only reflect the decisions of students immediately after graduate school; many often transition into industry or other private sector careers later on. Here is a list of just a few of many career possibilities with a Ph.D. in Neuroscience:

- Academic research
- Medical school (to obtain a second degree or to teach medical students)
- Law school (for scientific patents, advocacy, policy making, etc.)
- Business school (for scientific entrepreneurship or marketing within a company)
- Academic administration
- Industry: BioTech, Pharma, or provider of research materials/tools
- Science writer or science publishing
- Clinical trial administration
- Program management or research within government (such as: Department of Defense, Department of Health and Human Services [e.g. NIH], Department of Agriculture)

The Society for Neuroscience also hosts the *NeuroJobs* Career Center, a website that functions as both a job-posting/job-seeking network for neuroscientists as well as an informational hub about career possibilities. It provides very detailed information about all of the career options listed above in addition to resources to help refine your professional skills. Lastly, it is also host to the *NeurOnLine* Mentor-Matching Program, which is helpful for finding mentors or mentees who share your needs and interests.

Part 4: **Other Resources**

List of neuroscience undergraduate & graduate programs by state (*not entirely complete!*):
https://neurosciencenews.com/neuroscience-programs/

Science's graduate program database by school, subject, and location:
http://sciencecareers.sciencemag.org/graduate_programs/school

Top 10 List of Alternative Careers for PhD Science Graduates from Cheeky Scientist:
https://cheekyscientist.com/top-10-list-of-alternative-careers-for-phd-science-graduates/

Society for Neuroscience's Report of Survey of Neuroscience Graduate, Postdoctoral, and Undergraduate Programs (Academic Year 2010-2011):
http://www.sfn.org/careers-and training/~/media/SfN/Documents/Professional%20Development/NDP/SurveyReportAY20102011.ashx

NeuroJobs Career Center:
http://www.sfn.org/neurojobs

NIH RePORTER:
http://projectreporter.nih.gov/reporter.cfm

NSF Award Search:
http://www.nsf.gov/awardsearch/

Suggested Reading:
Ultimate Grad School Survival Guide (by Lesli Mitchell)

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