THE GRADUATE COLLEGE
University of Illinois at Urbana-Champaign

A Guide to Preparing Fellowship Applications in STEM

Supplemental Document to the Proposal Writing Workshop

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Applying for fellowships and grants is an integral part of academic life in the sciences. External funding from government agencies, private foundations, corporations, and other entities outside of the university is essential to carrying out sustained research projects of significant scope. Maintaining a well-funded and productive lab requires both scientific excellence and skilled grantwriting.

Graduate school is an excellent time to develop and refine your ability to communicate your ideas and to get other people excited about helping *you* pursue them. A fellowship application presents a comprehensive picture of an applicant as a graduate student, a research scientist, a future colleague, and a member of a profession. Multiple components form a unified whole that provides reviewers with the information they will use to select the recipient of a fellowship, scholarship, or grant.[1] This guide is intended to support Illinois graduate students in preparing a competitive application. Our office also offers workshops *and* an extensive collection of successful proposals. These provide concrete examples of everything I discuss below.[2]

In this guide, I'm going to address some of the common components of a fellowship application, including letters of reference. It is not meant to take the place of advice and instruction from other sources, notably that of your advisor, but to cover some of the basics at a high level. Let's begin with an overview of the most common components of a fellowship application:

- The résumé or *curriculum vitae*. This is the bullet-point summary of your educational and professional trajectory.
- The research proposal. This lays out your central question or hypothesis, why it is important, and how you intend to carry out your work.
- Letters of reference. Others will write these, but I'll offer some suggestions for how you can help your recommenders prepare their letters.
- Transcripts. These detail your formal training to date. Make sure you know whether you need official or unofficial transcripts and plan accordingly.
- Other components pertaining to you might be a personal or professional goals statement, a training or mentoring plan, or a letter from a host institution.
- Other components pertaining to the research might include a budget and justification, a data management plan, approval to work with human subjects or animals, or evidence of having completed ethics training.

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[1] Unfortunately, there is no standard terminology. A "fellowship" is generally a more substantial award that offers a stipend and sometimes tuition; a "grant" is for a specific project. A "scholarship" is usually a smaller lump sum.

[2] For information on our workshops, sample proposal collection, and one-on-one proposal review for Illinois graduate students, visit the Office of External Fellowships website: http://www.grad.illinois.edu/extfellowships.

Some of these components have to be prepared or formally reviewed by other people, so take the time they will need into account when you do your own planning. I will discuss them below, beginning with an in-depth look at the document that lies at the heart of a fellowship application: the *research proposal*, sometimes also referred to as the *research statement* or *research narrative*.

The Art of the Research Proposal

Research proposals are a form of science communication: You have an idea you would like explore, and an audience (a review panel) that would like to hear about it. The research proposal is a vehicle for laying out the information the audience will need in order to understand your idea and to decide whether to allocate funds for you to pursue it. A well-structured proposal can help reviewers carry out their evaluation effectively. A research proposal is fundamentally different from a research paper. You're not only communicating information (citations to the literature, steps in a research plan), you are sharing a vision of how the project you propose will contribute to the field and to the funder's mission.

Proposal as Genre

Proposals are forward-looking, future-oriented documents. You've probably read a significant number of papers at this point, and you may have co-authored some as well. Although writing a paper can be challenging, you have the advantage of having a clear starting point and outcome. You planned to do something, you did it, and you are reporting on the result. A new project, on the other hand, is a journey into uncharted territory:

> "Research progress is very much like an ongoing story, with plot twists and surprises. A well-written application creates a tale that appeals to the reader. … Unlike a novel, however, the story is unfinished … and the questions you propose should reveal how you will unfold the next chapter."[3]

A good graduate research proposal centers on a *quest*. It is a hero tale in which you (the student-scientist), venture into the unknown and overcome obstacles to obtain a prize—the answer to your research question. Unlike in a folktale, however, you are not entirely alone, but are typically working in a larger context (the lab), so part of your challenge is to carve out your own niche by means of the research question you pursue. Carving out this niche is part of a more extensive journey of in-depth study and training on the road to research independence.

Although the specific question you ask is necessarily limited in scope by what you can accomplish as a graduate student with a timetable for completing your degree, a good question contributes to the field more broadly. It is part of an intellectual conversation among scientists worldwide. Your project builds on their work, and they will build on the outcome of yours, moving the field ahead. That's the *common* quest you are pursuing.

There's yet another quest to consider. While your research project must advance both your field and your own scientific development, it must also fit with the funder's goals. Some funders have a broad mission of advancing basic science. Many have a more specific mission, such as supporting research that will

[3] Yang, Otto O. *Guide to Effective Grant Writing: How to Write an Effective NIH Grant Application*. Second Edition. 2012. New York: Springer Science Business Media, Inc.

improve stroke prevention or recovery. Once you know more about the funder's goals, you can articulate a vision that ties the success of your project to the funder's broader area of concern.

An example might be helpful here. Advances in communication technologies have had a global impact. Let's say that you are part of a lab that does antenna research, and that your project explores a means of improving broadband antenna efficiency. The success of your project will lead to publications (good for you and your lab) that expand knowledge about an aspect of antenna design (good for the field). An industrial research lab might care about the application to commercial cell phone technology. The Department of Defense is likely to care about an improved ability to support combat operations. In this case, one research project offers at least two visions for long-term impact.

Knowing which of these elements to emphasize and at what level of detail to discuss them is fundamental to writing an *effective* proposal for a *specific* competition. To do that, you need a strong understanding of the funder's mission and the reviewers who will be reading your proposal. Fortunately, most funders provide you with the information you need to make decisions about how to present your research.

Understanding the Application Requirements

A funder will have information about their mission and the fellowship they are offering on their website. In many cases, a funder will also post a "Call for Proposals," "Program Solicitation," or "Request for Applications," downloadable as a pdf, with further details. From now on, I'll simply refer to "the solicitation" to encompass any format in which the funder communicates the rules of the competition.

The solicitation will specify at a high level what the funder hopes to accomplish through the fellowship. It will list the eligibility guidelines, including citizenship requirements, stage of study, and supported disciplines. This information will give you insight into the funder's intensions. The solicitation will also contain details about the deadline, required components, formatting, length of proposal, number of references, etc. Don't underestimate the importance of any of these requirements. Some funders will automatically reject any applications that fail to comply without considering either the merits of the project or the applicant.

Somewhere in the solicitation, you will also find contact information and, ideally, the name of the Program Officer—the person who oversees the competition and assigns proposals to reviewers. If you have any questions about eligibility, format, or fit between your research and the funder's mission, contact the funder directly and get the response via email, not over the phone. Be sure to read over the solicitation carefully first, and email with questions in a timely manner.

Understanding the Audience

Once you understand the guidelines and have an appropriate project in mind, you will need to figure out who your audience—the review panel—will be so that you can write accordingly. To do this, you will need to assess what kind of a review panel the funder will put together. There are three basic kinds of panels:

> *Disciplinary*. In this case, the reviewers will be experts in your field, broadly speaking (e.g., chemistry or mathematics). However, they may not be experts in your specific area.
>
> *Topical*. Reviewers will have expertise in a particular problem domain (e.g., drug abuse), but may come at the problems from different angles (e.g., basic vs. clinical research).

Multi-disciplinary. People from multiple disciplines will read your proposal. For the Beckman Institute Graduate Fellowship program, for instance, any faculty member affiliated with the Institute may serve as a reviewer. For the Ford Foundation Fellowships, reviewers are drawn from a broad range of disciplines, including those outside of the sciences.

Sometimes the solicitation will be explicit about the review process and the composition of the panel ("experts in your field," "prominent transportation professionals," "a general scientific audience"). Most commonly, reviewers evaluate proposals independently and assign a score or ranking, then meet to compare their assessments and discuss discrepancies. If there is significant disagreement, an additional reviewer may be asked to evaluate the proposal. Our resource page links to a mock NIH panel discussion that will give you a sense of how that process works. If in doubt, contact the program officer.

Knowing who is likely to be reading your proposal will guide you in deciding on the level of technical detail that is appropriate. It will also help you know how to frame the outcome and impact of your research. A narrow, disciplinary audience is more likely to understand the basic scientific contribution of your proposed project. For a broad, multi-disciplinary audience, it may be equally important to talk about how your work will address a broader problem, such as antibiotic resistance or carbon emissions. If possible, look at successful past proposal to see how other applicants found the right balance.

A handful of competitions have a multi-stage review process. For example, for the Global Young Scientists Summit in Singapore, each department may select one nominee for consideration at the university level. Then the university may nominate up to five finalists for the international competition, from which 300 participants will be selected. A proposal for this competition must be written with both a disciplinary and multi-disciplinary audience in mind.

<u>Matching Scope of Project to Stage of Study</u>

Funders who offer graduate fellowships are motivated, more or less, by two factors. They want to support good science, and they want to train good scientists who will graduate in a timely manner. The project you proposed must not only be important, but it must be (a) achievable by you, with the training, mentorship and resources available to you, and (b) achievable within a timeframe appropriate to your stage of study. How do funders typically divide that up?

Fellowships open to master's students are well-suited to students in a two-year research-based master's program. An applicant who applies at the start of their first year would propose a project that can be successfully completed by the end of their second year, generally culminating in a thesis or final project.

"Predoctoral fellowships" are designed for students at an early stage of their graduate career and typically offer multiple years of support. A research proposal will outline broadly the project a student anticipates carrying out over the course of their doctoral program. It should be of an appropriate scope for a dissertation. Recipients do not lose their fellowship if their project changes over time. Funders understand that students early in their graduate career are exploring new areas and ideas as they take courses and complete rotations, and that their interests may change over time.

"Dissertation fellowships" may only offer one or two years of support. Depending on the competition, applicants must generally have advanced to candidacy either at the time of application or by the start of the fellowship. It is up to you to communicate to the reviewer what makes the question new and exciting,

and to lay out what you have done, are currently doing, and plan to accomplish during the term of the fellowship. Reviewers will look for evidence that the project will make a meaningful contribution.

"Postdoctoral fellowships" support scientists who have completed a doctoral degree. Most are for a short (1-2 year) period of time, allowing the recipient to acquire new skills or branch out into a new area. Generally, postdocs are intended for scientists with a Ph.D., but applicants with other doctoral degrees may also be eligible (e.g., MD or DVM). Some "postgraduate" fellowships are appropriate for terminal master's degrees such as the Masters of Public Health (MPH). See below for a further discussion of postdoctoral fellowships.

Back to Storytelling

Those are the things you need to figure out before you sit down at the keyboard to write about your scientific quest. None of that changes the details of the research you are doing—the hypothesis you are testing, the experiment you are running, the analysis you will conduct. However, it does affect the level of detail, the nature of the vision, and the balance between the two that you will use in the proposal. Now we can move on to laying out the science.

Proposal as Roadmap

In the section above, I talked about the proposed project as a journey into uncharted intellectual territory. The proposal narrative must convince a reviewer that you have some good ideas for how to explore that territory and they must believe that the journey will be worth it. The National Science Foundation (NSF) sums their expectations up as follows:

> "Proposers should address what they want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified."[4]

This is a pretty good summary of what information you need to provide a reviewer in order for them to fully assess the merits of your project. Does that mean that there a right way to structure a research proposal? No, there is not. However, in many disciplines there are common models or approaches. This is why it is essential to get samples of successful proposals in your discipline or, if you are carrying out multi-disciplinary work, from the full range of disciplinary areas that your research encompasses.

Basic Proposal Anatomy

Although there is no one right way, I will offer a framework that can be adapted across many disciplines and competitions. This framework is based on the *role* each of the following elements plays in laying out a narrative for the reader, regardless of what specific section headers are used (e.g., "Background" vs. "Literature Review").

Title. An effective title is a mini-proposal that encapsulates the essence of the project and introduces the problem, method, and outcome. Titles are often used by the program offices to assign your proposal to an appropriate review panel, and may be the only part of your proposal that they read.

[4] NSF, *Proposal and Award Policies and Procedures Guide*, Part I, Chapter II.C.2.d

Introduction. This, too, is a mini-proposal; it lays out the project at a high level. It generally begins with an articulation of the broader vision, includes the central hypothesis or objective, and states the anticipated form of the outcome. How long should the introduction be? That depends on the amount of space you have. If you are preparing a two page research narrative for a disciplinary audience, a single paragraph might suffice. If you are preparing a ten page narrative for a multi-disciplinary audience, you might choose to allocate more space, and use the introduction to provide a broad overview of the project that will be understandable by all reviewers.

Literature Review & Preliminary Data. This section gives a selective overview of the area that outlines the current state of the field and the past research upon which the proposed project is based. It may discuss a gap in current knowledge, controversies or disagreements, a novel intersection of two fields, and any promising new directions. This section might include a discussion of preliminary data and the applicant's current work, if applicable. By the time the reviewer is done reading it section, they should be convinced that the proposed project is well grounded in the literature, and that it is a natural next step for the field and for the applicant. How much preliminary data is expected? That will depend on the nature of the problem and the level of the applicant. A predoctoral applicant, for example, may just be starting to collect data, or may be using data collected by someone else in the lab, whereas an advanced doctoral student might be already citing their own publications in this section.

Statement of the Research Question. *What* the applicant intends to do is the heart of the proposal. Depending on the discipline, this may be framed as a *research question*, but it may also be stated as a *hypothesis*, *goal*, *objective*, or *aim*. The background section might culminate in the statement of the research question; alternately, it might be placed at the start of the section outlining the research plan. Thus, it is not exactly a separate section, although applicants may use bold or italic type to highlight it. Instead, it serves as a transition between *why* the research question is important and *how* the applicant will set out to answer it.

Research Plan/Methodology. This section lays out how the applicant will go about answered the proposed question conceptually and practically, leading the reader from the general to the specific. It can often be laid out as a branching structure: an overall objective might be accomplished through a set of goals; a central hypothesis might break down into a set of specific aims. Each of these would then be accomplished through a series of steps. This section should lead the reviewer from start to finish, so that they can develop a picture of how the applicant will spend their time over the course of the fellowship. It may be appropriate to discuss how much time will be spent on each phase of a project (data on x will be collected over a two month period). In some cases, it may be valuable to include a timetable.

Resources and Mentorship. Research in the sciences requires access to specialized facilities and equipment, and specialized training in order to use them. A handful of funders require additional components discussing their availability. For those that don't, it's worth working this information into the research narrative. Graduate students, might start by stating, "This project will be carried out in the Lab/Group/Center at the University of Illinois, Urbana-Champaign, under the guidance of Prof. X." The narrative can then elaborate on specialized resources and mentorship related to the project, e.g., access to Blue Waters or a collaboration with a major medical center.

Pitfalls and Alternatives. Ah, a multi-year journey into the unknown… what if something goes wrong? Funders want to know that you have thought about potential major obstacles that might derail your project. There's no need to discuss proven techniques or routine employed technologies. However, if

you are using a novel approach or strategy, be sure to discuss potential pitfalls and alternatives with your advisor, and include them in the narrative. Whether or not a solicitation explicitly asks applicants to address this in the proposal, reviewers will judge your ability to anticipate problems and overcome them.

Outcome and Dissemination. Ultimately, this is why a funder is giving you money. This final section tells the reader what an outcome will look like and how it will contribute to the field—the *scientific merit* of the project. It may also lay out where you intend to disseminate the results, including both conferences and journals. In the background section, you cited other people; this section is about why people will cite you and how they will learn about your work. You may choose to explain how the outcome will contribute to the funder's mission as part of this section, or you may choose to address that issue separately.

Addressing the Interests of the Funder

The application instructions may not require a separate section on the fit between the research outcome and the funder's mission, but applicants may choose to include such a section using language found in the solicitation. For example, if a funder specifies that the proposal should address the innovative nature of the research, you could add a section entitled, "Innovation," in which you talk about what makes the research innovative. If the funder specifies that the outcome should have an impact on population X, you could add a section, "Impact on X." By encapsulating this information in a separate section you make it easier for the reviewer to identify the fit between outcome and mission.

National Science Foundation

The National Science Foundation (NSF) accepts a broad range of formats for the research narrative. However, there are two sections required by the NSF that are distinct from other funders. Applicants *must* have sections entitled "Intellectual Merit" (IM) and "Broader Impact" (BI). The mission of the NSF is not just to fund outstanding research (IM), but to support *researchers* who will make a positive contribution to society through technological innovation *and* STEM education (BI). NSF offers extensive guidance on what qualifies as IM and BI, and students applying for the NSF Graduate Research Fellowship (GRF) will find many examples and suggestions online, including on our resource pages. In addition, we offer an information session on applying for the GRF at the start of the academic year.

National Institutes of Health (and NIH-Style Proposals)

Contrary to what I said above about there being no right way, if you are submitting a proposal to the National Institutes of Health (NIH), be aware that there is a *highly standardized format* for every single section from which you *should not deviate*. NIH has extensive instructions online, and there are entire books devoted to proposal preparation for NIH (see our online resource page). We offer an annual workshop in November for prospective applicants. Preparing an NIH proposal is a complicated and strenuous endeavor that involves significant time, effort, and contribution on the part of your advisor and other collaborator(s).

What about "NIH-style"? Other funders have borrowed from the NIH model. For example, the same research narrative format is appropriate for American Heart Association (AHA) fellowship proposals. The AHA also requires the same style of bibliography, biolographical sketches, a training plan, and several other sections. This is also the case for fellowship proposals to the United States Department of Agriculture (USDA). The PhRMA Foundation instructions explicitly state, "Please use a format similar to

the format specified for grants submitted to the National Institutes of Health." If you're in the biological sciences, this is the format to learn.

Incomplete List of Additional Steps & Components

It's easy to forget that a proposal *application* is more than the research narrative. Read the solicitation to see which components you are required to submit and in what format, and allow plenty of time to assemble them.

Portal Registration. Many funders now require you to register prior to application and use their portal to upload your documents. Without an account, you cannot submit. Registering may include filling out online forms with information about your educational background, research experience, etc. If this is the case, don't put this off until the last minute—it takes time to fill in all the boxes.

Abstract or Summary. There is great variability in what funders are looking for. A limit of 250-500 words is common, and the general expectation is that you will provide an overview of the proposed research, much like the introduction I discussed above. Most graduate fellowship proposals do not require a separate abstract. Some funders require that the abstract be written in the third person; this abstract or summary of the research may be posted publicly if the grant is funded (this is the case with NSF—you can find these abstracts on their website).

Résumé, *Curriculum Vitae*, or Biosketch. The résumé or "CV" serves as a summary of your educational and professional trajectory. For graduate students, this is generally limited to undergraduate and graduate study, training, and research, plus any work experience during that time, including internships. Additional information may include professional activities and affiliations, teaching experience and, in some cases, science-related public or educational outreach activities. There is usually a page limit, so you will want to pick and choose which items to highlight for a particular competition. If submitting a résumé in addition to filling in an online form, make sure that the information is consistent (e.g., employment dates match).

Some funders ask for a "biosketch," a highly structured document that includes information similar to what you might have on your resume. In addition to education, experience, publications, and awards, you may be asked for a brief paragraph about your plans for training and professional development. As always, check the solicitation and use successful proposals as models for developing this component.

Training or Mentoring Plan. Graduate fellowships offer support for you to develop as a scientist. Some require a mentoring or training plan. This may be a separate document or it may be a section in the main research narrative. This training plan lists the people you will work with, including your advisor and any collaborators, and how each of them will contribute to your development. It may include formal or informal training required in order for you to undertake your project.

Ethics and Data Management. Depending on the nature of the research and the funder, you may be required to submit one or more of the following documents. These may take time to prepare, and will require campus approval from offices and committees outside of your department. If the first version you submit is not approved, you will have to revise and receive approval for your revision. Here are the most typical components:

- If you are using human subjects, you will need approval from the *Institutional Review Board* (https://oprs.research.illinois.edu/).
- If you are using animals, you will need approval from the *Institutional Animal Care and Use Committee* (http://research.illinois.edu/regulatory-compliance-safety/iacuc).
- You may be required to complete ethics training. The IRB webpages have information on fulfilling this requirement (https://oprs.research.illinois.edu/required-training).
- You may need a Data Management Plan describing how you will collect, manage, store, and ultimately share your data. Check out the Life Sciences Library's online guides and templates (http://www.library.illinois.edu/lsdata).

As a graduate student, if your research is part of an established project, it is possible that you will not need to seek your own IRB or IACUC approval. Check with your advisor, who will also be able to provide you with examples of these components from their own proposals.

Documents Faculty Prepare

Advisor/Collaborator Biosketch. Some funders (notably NIH) require the advisor and other mentors or collaborators to submit a "biosketch." This typically includes information about their background, the work being done in their lab, a list of publications, names of students they have successfully mentored, and major awards they have received.

Host Letter. If part or all of your proposed project will be conducted outside of your advisor's lab, the head of that other lab may need to provide you with a formal invitation. This should spell out the facilities to which you will have access, and the guidance and mentorship you will receive.

Components Involving Campus Units

Budget and Justification. The budget is the numerical expression of the technical project. Each line item should have a direct connection to activities discussed in the proposal narrative. An ecologist collecting lichen might list transportation to/from a field station and equipment for storing samples. The budget justification would offer details, for instance, that transportation costs include an undergraduate summer research assistant from the lab, and that the field station will offer free accommodation.

If you are applying for a graduate *fellowship*, it is unlikely that you will need a budget. Fellowships that are designed to support you and your studies generally provide a lump sum in the form of a stipend and/or tuition. However, if you are applying for a grant to support a specific project, you may need to provide a budget and a budget justification. *Be sure to check the solicitation carefully to see if there are any restrictions on what the funder will cover*. Most funders will not allow "overhead" for graduate student grants. This additional amount is commonly part of faculty grants to help cover organizational expenses at the departmental and university level.

You'll also need to figure out how the funds will be disbursed and what documentation you will need for your expenses. If you receive the grant, the money might be sent to you directly. However, it is possible that it will be sent to the university, which will then give it to you according to a set of rules, policies, and paperwork. Some funders require you to submit your application through the university (see below, Institutional Submission). If this is the case, there will be a pre-submission process for budget approval, starting with your departmental budget officer, whom you should contact early in the application

preparation process. They will need to review it before submitting it to the Office of Sponsored Programs (OSP), the campus-level unit that represents the university, for their review. Read on…

Institutional Submission. This may apply to both *fellowship and grant applications*. Check the guidelines to see if "institutional submission" is required—this will usually be the case for major funders, particularly government agencies such as NIH and NSF. This means that, although you will be the one preparing the application, the university will submit it to the funder on your behalf. If you receive the grant, the funder will transfer the award amount to the university, which will then distribute the funds to you and/or your department.

The first step in this process will be to contact the departmental budget officer. You will not be the only person submitting an application at any given time, so do not expect them to drop everything at the last minute to deal with your paperwork. Give them plenty of notice (weeks in advance) and make sure you understand what information they will need from you and when. The same applies to working with OSP (http://sponsoredprograms.illinois.edu/), which maintains a handy list of departmental contacts (http://sponsoredprograms.illinois.edu/proposals/prep_coordinator.html).

Budgets and institutional submission are tricky and subject to departmental, university, state, federal, and funder procedures, guidelines, and restrictions. If in doubt, ask the professionals—your departmental budget officer, the program officer, and OSP—for help.

Personal/Professional Goals Statements

If you are applying for a fellowship, you may be asked to provide a personal or professional goals statement. This is your opportunity to provide additional information that will help the reviewer evaluate you as a candidate, but that doesn't fit into a research proposal or résumé. This is more common in the case of predoctoral fellowships for which you apply at an early stage of your career, sometimes only a couple of months after starting a graduate program. For these fellowships, the funder will consider your history as an undergraduate in judging the likelihood of success at the graduate level.

In these statements, funders may ask you to elaborate on prior work or research experience. They may also wish to learn about your motivation to pursue graduate studies, your professional goals, or educational outreach activities in which you participated as an undergraduate. The length of these statements varies considerably. The NSF GRF personal statement is the most substantial at three pages in length, and gives applicants considerably leeway in deciding what they want to include. The National Potato Council, on the other hand, asks applicants to limit themselves to 200 words in discussing their goals and ambitions, and the benefits of their research to the potato industry. For more on this topic, as well as examples from successful applications, read, "Applying for Fellowships: Telling the 'Story of You'" at https://illinois.edu/blog/view/6397/481826. Our sample proposal collection also includes personal statements.

Relationship Building and Letters of Reference

In most cases, you will need three letters of recommendation. A strong letter is one that can speak persuasively and in detail about you as a researcher and your promise as an independent scientist. Whom should you ask? That depends on several factors.

The most natural person to ask is your advisor. If you have just started graduate school, you may not yet have joined a lab. However, most departments will assign you an advisor, or you may be working in someone's lab as part of a rotation. If you are at an early stage of your graduate career, you can ask for letters from people you worked with as an undergraduate or as part of an internship. These will likely be the same people who wrote letters for your successful application to graduate school.

As you progress, you will develop a long-term relationship with an advisor, and will begin to build relationships with other faculty. These might develop through courses you take, or discussions you have outside of class about their areas of interest. Over time, you will select committee members, who will become familiar with you and the research you are pursuing. Depending on your lab and the nature of your work, you might be part of a collaboration on campus or elsewhere. Building these relationships should be a natural outgrowth of becoming an engaged scientist who actively reads the literature, discusses advances in the field with others, and contributes through presentation and publication of their own work. These activities lead to a stronger network and stronger science overall, as well as connecting you with people who can write good letters on your behalf.

Although you don't write letters of recommendation yourself, you are in a position to help your recommenders. Ideally, the people you ask for letters will already have a good understanding of your project through prior conversations. You can help them prepare a letter for the specific fellowship for which you are applying by providing them with the following:

- A FAQ with key points about the fellowship and why you're a good candidate. Be sure to include the *deadline* and any special instructions for letter writers.
- An up-to-date copy of the résumé you will submit for that competition.
- A draft of your research proposal and any other application components.
- Copies of papers, including those in preparation, related to the project you are proposing.
- A print copy of the solicitation, if available.

Make sure to do this well ahead of the deadline and ask your recommenders if they would like a reminder. Even if the people you are asking have copies of past letters they have written for you, they still need time to update them and shape the letter for this competition, just as you are shaping your proposal. Ask if they would be willing to offer comments and suggestions, giving them plenty of time to give you feedback, and yourself time to incorporate it into your final draft.

A Word on Postdoctoral Fellowships

Postdoctoral fellowships, also known as "postdocs," support scientists who have completed their doctoral degree. The most common way to find a postdoc is informally. For instance, your advisor might know someone who has an open postdoc position in their lab. Labs and institutes might also post these positions online. In this case, the funding for the postdoc will come from a current faculty grant, and you will be hired with a specific project in mind.

However, there are also postdoctoral fellowships offered by foundations, institutes, etc., for which you can apply directly, and which are not tied to a specific lab. Like predoctoral fellowships, the focus of these fellowships is typically two-fold: the project that will be carried out *and* the mentoring that the postdoctoral fellow will receive. These kinds of postdocs are useful when seeking out additional training or branching out into a new domain. They tend to be for a short period of time—one or two years—and

generally require that your project be carried out at a different institution from the one where you completed your doctoral studies. Many are focused on research in a particular problem domain (e.g., heart disease or conservation science), though some support basic research in a broad range of disciplines (e.g., the Life Sciences Research Foundation).

The burden is generally on the applicant to identify a potential host laboratory prior to submitting an application, and propose a project they would like to undertake (funders often provide a list of eligible hosts or sponsors). In addition to a firm commitment from a host, applicants may have to include a detailed mentoring and training plan. In cases where a foundation or institute supports a limited number of fellows annually, finding a host lab does not guarantee a fellowship. You will still be competing with other applicant-host pairs for the award.

Funders often use the term, "early career applicant," to describe who may apply, but there is no uniform definition. Potential applicants should read the guidelines carefully to see whether they need to have completed the degree at the time of *application* or at the *start of the fellowship*. Those who already have a Ph.D., such as current postdocs, should check how long ago they may have received it in order to be eligible. The application processes for postdocs vary widely, so it is important to thoroughly read the solicitation and email the funder directly with questions.

User-Friendly Writing

Let me offer a few tips for making your proposal easy to read while highlighting key ideas for the reviewer. I also encourage you to check out the writing resources we link to on our resource page (http://www.grad.illinois.edu/extfellowships/resources), and take advantage of the individual writing consultations offered through the Center for Writing Studies (http://www.cws.illinois.edu/workshop/).

Carving out your niche. Faculty proposals are generally written *in the third person*: "Data will be collected and analyzed." Who will collect the data? Who will analyze it? The funder doesn't care as long as the work gets done. However, if you are applying as a graduate student, the work will get done by *you*. This is why graduate fellowship and grant proposals should be written *in the first person* make your role clear: "I will collect and analyze data." That doesn't mean that every sentence has to begin with, "I will." It does mean that the language you use should clearly distinguish between what the lab does and what you will be doing: "Our lab isolated…. I will now use the strain to…."; "We established that…. In Aim 1, I will build on that result by…." This helps the reviewer identify *the intellectual niche you are carving out for yourself* within the larger lab.

Audience, Terminology, and Level of Detail. Let's go back to the discussion of audience and review panels. Consider carefully the terminology and acronyms with which they might be familiar. I didn't assume everyone would know that AHA stands for the American Heart Association—I used the name followed by the acronym in parentheses (AHA) before I switched to the acronym only. How about terminology such as "murine model"? Biologists will know what a "murine model" is, but if your audience could include a civil engineer, you should probably use the word "mice" instead. Even if reviewers are in your discipline, they may not be familiar with all of the terminology that's common in your area.

You can also write at different levels of detail in different parts of the proposal. In the introduction, you might talk about physical activity slowing or preventing cognitive decline in aging. In the body of the proposal, you might talk about how an increase in the expression of BDNF has been correlated with an

increase in anterior hippocampal volume following an aerobic exercise intervention, providing a potential mechanism for cortical gains. One idea can be articulated in multiple ways.

How can you figure out what will work for the anticipated audience? Ask people outside of your lab, and possibly outside of your discipline, to read a draft of your proposal and give you feedback. This doesn't mean that every reader has to understand every word, but reviewers have to be able to follow your ideas well enough to be convinced that you are proposing a viable and worthy project. Sample proposals provide examples of how others have struck the right balance.

Writing for Busy People. When applying for a fellowship or grant, you are not only in completion with other applicants, you are in competition with other activities that require the time and attention of the reviewers, including teaching, research, family responsibilities, and writing their own grants. How can you help them out? Here are a few thoughts:

- Use strong, declarative language. The purpose of a research proposal is to communicate scientific ideas and anticipated outcomes in a straightforward way.
- Stick to short sentences and paragraphs. These are much easier for a reader to scan, particularly if they are reading on a tablet.
- Use headings for key section. A reviewer may read your proposal one day, but need to go back to find some information when they write their review or discuss your proposal on a panel.
- Emphasize the hypothesis and goals. Use bolding and italics to emphasize and highlight key elements such as the hypothesis, the specific aims, the long- and short-term goals.
- Identify key steps and phases of your plan. Lay out your proposal in a way that helps the reviewer understand both the conceptual and practical breakdown of your research plan.

Visuals. There's a saying, "a picture is worth a thousand words." A confusing graph, chart, or image, however, is an annoyance and detraction. A good visual element encapsulates a key point, is near the text that explains it, makes sense to the target audience, and has readable labels. Don't rely on color—your reviewer might print out your application on a standard photocopier, or might turn out to be colorblind. A good visual *enhances* a well-written narrative that can stand on its own.

Feedback as Essential Ingredient

As you explore opportunities for grants and fellowships, make sure to keep your advisor in the loop. Your advisor's feedback is essential to making sure you have a solid research question and a viable research plan before you begin preparing an application. Your advisor can discuss potential opportunities with you, including the training and resources your project will require for its success, to make sure the fellowship is a good fit.

Ask your advisor, committee members, lab mates, and others in your field for feedback on all of the components you intend to submit. Even if you are submitting essentially the same proposal to multiple competitions, you will still want to get feedback on whether you have done a good job of shaping it for each funder's mission. Illinois students may also use our one-on-one proposal review service after they have fully incorporated their advisor's suggestions. While our office cannot offer scientific advice, we do work with students on all other aspects of proposal development.

Final Thoughts

Although this guide is written with graduate fellowships and grants in mind, the principles upon which it is based apply to grantwriting generally. If you pursue an academic career, you will need external funding to support your lab and travel to conferences. You may be expected to cover part or all of your own salary. Grantwriting will become an ongoing part of your professional life.

Even if you don't choose to continue in academia after graduation, you will need to advocate for the work that you are doing and the people who work for you. Competition for resources is a fact of organizational life, whether you are in an industrial R&D setting, working at a national lab, or pursuing a non-scientific career. The skills you develop as a proposal writer—understanding an audience, laying out your ideas, and assembling a comprehensive set of materials—will transfer to these other settings. Regardless of the nature of your work, you will periodically be called upon to tell others what you want to do, why it's important, and how you will accomplish it.

If you are ready to look for external fellowships and grants, our Fellowship Finder database is a good place to start: https://www.grad.illinois.edu/fellowship/. We have a handy online "user guide" to help you use it effectively: https://illinois.edu/blog/view/6397/403921. We wish you the best of luck in finding opportunities that are right for you.