CHAPTER 2

HOW TO DEVELOP AND OPTIMIZE THE IDEA FOR YOUR GRANT APPLICATION

The application you write can only be as good as the idea with which you start: If you don't have a compelling, novel idea that will drive your field vertically, you're unlikely to be funded. No amount of 'window dressing' — grantsmanship — can overcome lack of a good idea. Therefore, you (and we) need to do everything possible to ensure that your starting point — your idea — is nothing short of outstanding.

The best idea of which you are capable is usually the product of a step-by-step developmental process, i.e., it rarely occurs as a spontaneous event. These are the steps that we recommend you take to maximize the potential importance of your idea.

DEFINE THE PROBLEM THAT YOU WANT TO ADDRESS

First, within the scope of your overall research interest, select a niche area that is not overworked, i.e., a subdivision of your broader interest that can be systematically and vertically developed by you. It is critical that you do so, because very few reviewers will care about funding your application if what is proposed only confirms or horizontally extends the work of others.

Second, identify the long-term goal you have within the niche area. It should be more than what could be accomplished under the auspices of a single period of grant support, but not so ambitious that it would be seen as unrealistic within the span of your career. Next, conceptualize the step-by-step continuum of research that would be required to attain the long-term goal you have identified.

Third, identify the next logical step that must be taken along the continuum of research that you have identified. In contrast to the long-term goal, the problem – the next step - that you select here should be one that can be resolved under the auspices of a single period of grant support. The problem that you select will become the subject of the proposal you write.

COLLECT AND CRITICALLY ANALYZE BACKGROUND INFORMATION THAT PERTAINS TO THE PROPOSED AREA OF INVESTIGATION

A comprehensive review of the literature is the next step in generating a fundable idea. This is necessary for at least three reasons. First, you need to determine what is already known. Second, the extent to which that body of knowledge is reliable needs to be critically examined. And, third, you need to determine who has been actively publishing in the field during the past ten years.

There are many different ways to explore the current and past literature of a field. Examples of some of the databases and services that may be helpful are included in the text box, below. Others can be identified by typing 'Literature Databases' into any Internet search engine.

Literature Databases and Services

Highwire Press (http://highwire.stanford.edu/)

759,333 full-text articles are free, with about 3,000 more free each month, making HighWire the largest archive of free life science articles in the world. Includes the biological, medical, physical and social sciences. A free e-mail alert service is available.

Thompson ISI (http://www.isinet.com/cit/)

Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index and more. These services offer a unique search method, cited reference searching (identification of authors who have cited a previous publication). Available through most university libraries.

Determining what is known and not known requires that you do more than read abstracts online; *detailed and critical analysis* of the pertinent past and current literature is required. One helpful approach is to photocopy the first page of any journal article that you want to evaluate. The first page will almost always contain the authors' abstract. As you read the paper, annotate the photocopied first page with any important information that was not included in the abstract. Also include remarks about the quality of the work, as well as the conclusions that were drawn from it. The annotated photocopy can then be filed / catalogued for future reference. *During the course of your literature review, create a list of key words that describe the field, as well as the names of investigators who have been active in the area during the last ten years* – the reason will become clear later in this chapter.

HOW TO GENERATE A PRELIMINARY IDEA PERTINENT TO THE PROBLEM THAT YOU HAVE CHOSEN

As you work your way through the literature, you will become increasingly aware of what is known and what is not. Invariably, ideas as to which gaps in the knowledge base are most important, and how they can best be filled, will begin to occur to you. Write such ideas down, but at this stage in the development of your idea, don't spend any more time than that. Why? Because many of your early ideas will probably prove to be sophomoric as you become more critically conversant with the literature. Also, major shifts in your insight will almost certainly occur as you continue your review. And finally, some of your early ideas may be ones that other investigators have had earlier – and written grant applications about them. For all of these reasons, at this point, just put your preliminary ideas in a computer or index-card file or notebook and continue with / complete your critical review of the literature.

Once you have completed your review, go back to the ideas that you have collected. As you review them you may find that inspiration strikes immediately – but almost surely it will be the case that no one of the ideas will be as important as what you synthesize by looking at them collectively. If the idea doesn't come, don't be alarmed and don't force it: don't settle for less than an outcome with which you are completely comfortable. If you're not satisfied, take a few days off and then approach them in an effort to establish better how the ideas and concepts you have generated relate to one another. Eventually, the proverbial 'light bulb' will come on. When

it does, you will know it, because you will be genuinely excited by the prospects that become apparent to you. Then, you need to ask yourself this last, two-part question: *'Will this idea impact positively on my field – will it enable a vertical advance in my field – and*, if so*, can I convince others of that fact?'* If your answer to both parts is, 'Yes,' you've crossed the Rubicon and you're on your way to the next step in the process. On the other hand, if you find that you can't say with conviction that your idea has the potential to advance your field substantively, then you have to accept that you are not yet ready to write a competitive, i.e., successful, grant application. You either need to keep trying to evolve a more novel, important idea in the same area, or shift to a new problem that has greater potential to pass this 'impact' test.

HOW TO ASSESS YOUR IDEA'S POTENTIAL FOR SUCCESS AND MODIFY IT, IF NECESSARY

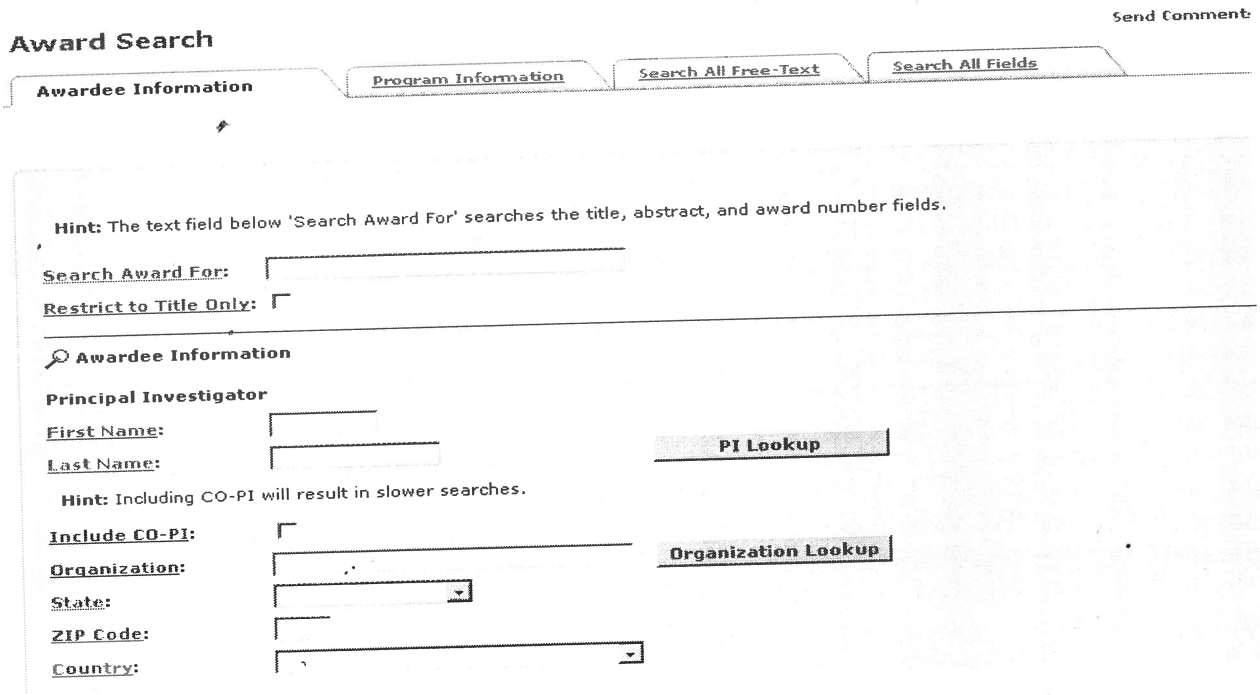
Assuming that you have been successful in generating an exciting (to you) preliminary idea, its potential for success should be assessed before you ever put pen to paper. Three very important steps must be taken:

1. Assess your own ability to pursue the idea. Regardless of how good your idea is, it must to be one that is within your capabilities to pursue. For example, will you, as Principal Investigator, have sufficient time to devote to the project? If you are a senior person with many different kinds of scientific, educational, and administrative responsibilities, is it credible to take on more? If you are a Beginning Investigator (definition: Grant Proposal Guide, chapter 1G.2; http://www.nsf.gov/pubs/policydocs/pappguide/nsf09_1/nsf091.pdf), are you in a position to commit enough time? The latter is an important question, because reviewers usually expect a greater time commitment from junior, compared with more senior, investigators. Will you and your collaborators have the expertise necessary to accomplish the work? If not, can the missing expertise be acquired by engaging one or more co-principal investigators, co-investigators, consultants or collaborators? Do you and your institution have the resources that will be required to pursue the kinds of research that will be necessary? If not, will you be able to obtain them? If you are proposing at the most competitive level, i.e., NSF's standard research grant, do you have sufficient preliminary data to convince reviewers that the project is feasible in your hands – not someone else's – yours? The answers to those and similar kinds of questions either have to be answered convincingly in your favor or there is little point in going forward, no matter how good your idea may be conceptually.

2. Assess and use your competition to advantage. Good ideas are often generated independently by more than one person. You need to know, therefore, what research has already been funded in the area that you are considering. Clearly, you want to avoid writing an application that is similar to one that has already been funded — and, if such grants are out there, you want to know about them so that you can make use of them to stimulate and extend your own thinking and planning. You can electronically access NSF-funded research grants that have been funded since 1989 by going to: http://www.nsf.gov/awardsearch/. A similar database, CRISP (Computer Retrieval of Information on Scientific Projects), exists for federally funded biomedical research grants (http://crisp.cit.nih.gov). It covers projects funded by the National Institutes of Health (NIH; the majority of entries), Substance Abuse and Mental Health Services (SAMHSA), Health Resources and Services Administration (HRSA), Food and Drug Administration (FDA), Centers for Disease Control and Prevention (CDCP), Agency for Health Care Research and Quality (AHRQ), and the Office of the Assistant Secretary of Health (OASH). The United States Department of Agriculture maintains the CRIS (Current Research Information System) database (http://cristel.csrees.usda.gov), which contains information about agricultural-

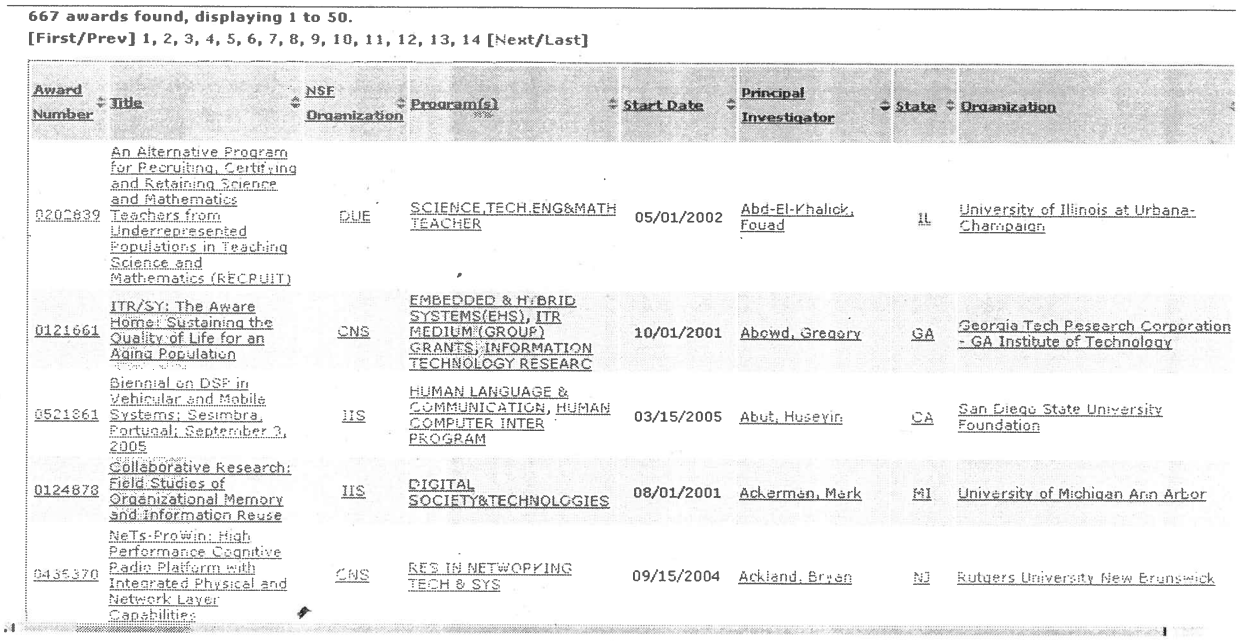
ly relevant research grants that have been funded by the Federal government. You can also access most federally funded research grants at http://fundedresearch.cos.com, as well as grants that have been funded by the United Kingdom's Medical Research Council. This is a Community of Science Internet site to which either you or your institution must subscribe (http://registration.cos.com/cos/basic.html)

To retrieve information from any of these databases, you can enter the names of individuals who either are, or have been, active in your field (determined from your critical analysis of the literature, especially of the last 10 years). In addition, you can use key words that are relevant to the idea that you are seeking to fund. Through this approach you can obtain an extensive amount of information on already-funded applications that are related to your idea. For example, at NSF's Award Search database (http://www.nsf.gov/awardsearch), you would choose the "Awardee Information" tab (see below).



The key words you have generated would be entered into the "Search Award For" box. The names of investigators who have been active during the past ten years would be entered into the boxes that appear under the heading, "Principal Investigator." Not shown, at the bottom of the query form, is the "Search" button that you would click to find the grants that are related to the words / names you have entered. Just above it are boxes that can be checked to limit the search either to active, expired or historical (prior to 1976) awards. If none of the information you enter produces a result, you are probably querying the database during a time when it is closed to use (incremental data load update occurs every day from 2:00 am to 4:00 am ET, and full data load update takes place every Saturday. NSF may have network, servers and/or database maintenance on Sunday).

The results you obtain will look something like the example at the top of the next page:



667 awards found, displaying 1 to 50.
[First/Prev] 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 [Next/Last]

Award Number	Title	NSF Organization	Program(s)	Start Date	Principal Investigator	State	Organization
0206839	An Alternative Program for Recruiting, Certifying and Retaining Science and Mathematics Teachers from Underrepresented Populations in Teaching Science and Mathematics (RECRUIT)	DUE	SCIENCE,TECH,ENG&MATH TEACHER	05/01/2002	Abd-El-Khalick, Fouad	IL	University of Illinois at Urbana-Champaign
0121661	ITR/SY: The Aware Home: Sustaining the Quality of Life for an Aging Population	CNS	EMBEDDED & HYBRID SYSTEMS(EHS), ITR MEDIUM (GROUP) GRANTS, INFORMATION TECHNOLOGY RESEARC	10/01/2001	Abowd, Gregory	GA	Georgia Tech Research Corporation - GA Institute of Technology
0521861	Biennial on DSP in Vehicular and Mobile Systems; Sesimbra, Portugal; September 2, 2005	IIS	HUMAN LANGUAGE & COMMUNICATION, HUMAN COMPUTER INTER PROGRAM	03/15/2005	Abut, Huseyin	CA	San Diego State University Foundation
0124878	Collaborative Research: Field Studies of Organizational Memory and Information Reuse	IIS	DIGITAL SOCIETY&TECHNOLOGIES	08/01/2001	Ackerman, Mark	MI	University of Michigan Ann Arbor
0435370	NeTS-ProWin: High Performance Cognitive Radio Platform with Integrated Physical and Network Layer Capabilities	CNS	RES IN NETWORKING TECH & SYS	09/15/2004	Ackland, Bryan	NJ	Rutgers University New Brunswick

Clicking on the column headings, with up / down arrows to their right, will allow you to search in either ascending or descending order. Clicking on either the award number or title will retrieve all of the information about that grant, including its abstract. All of the grants funded by an NSF organization, not just the ones related to your search, can be displayed by clicking on the acronym for that organization in the body of the table. Similarly, clicking on the name of an NSF program in the next column, the name of a principal investigator, a state, or on the name of an institution will cause all grants related to that entity to be displayed.

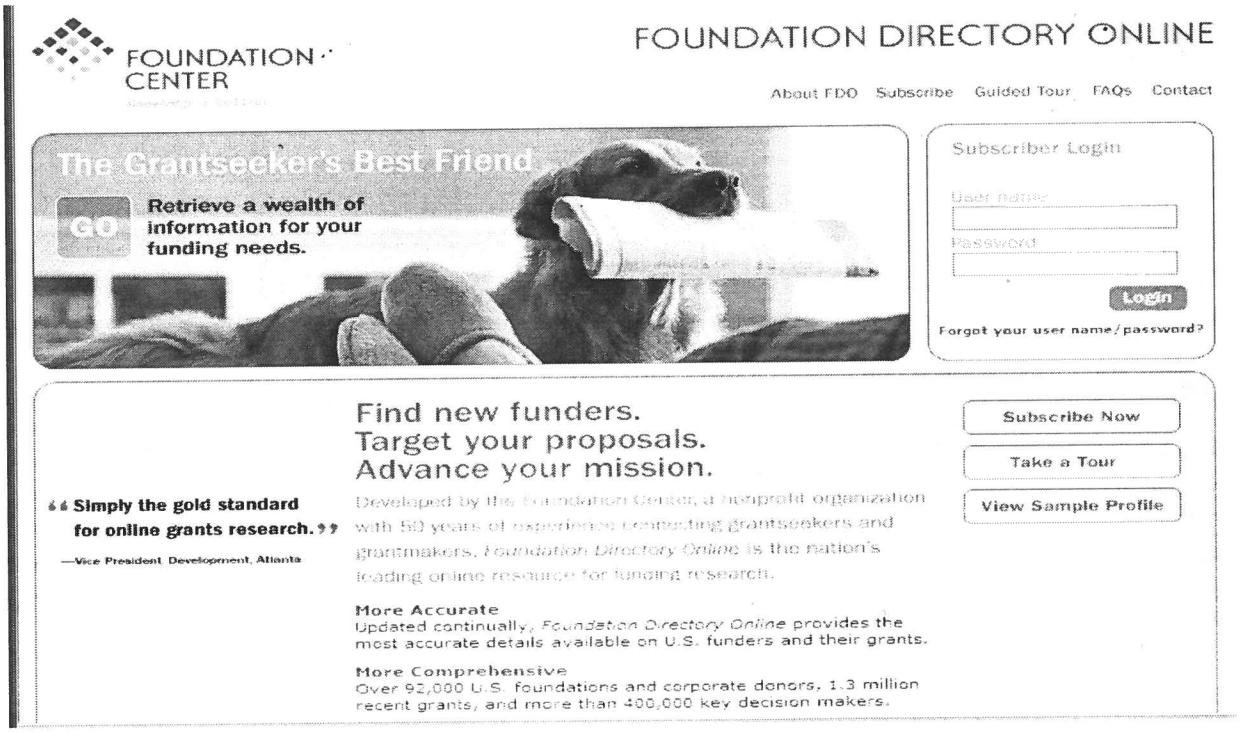
Some databases of funded grants (e.g., CRISP, but not NSF's Search Award Database) contain cataloging terms for each entry. When a grant is funded, someone at the funding agency creates a list of terms that reflect its content. Some of these descriptors often extend to information that is not covered in the abstract (e.g., a specific method). Careful consideration of these cataloging terms can lead to additional useful and new thoughts / approaches that will help you to develop and refine your own idea.

A day spent screening these databases can be invaluable!!! First, it will help you to avoid the trap that so many applicants fall into: it will prevent you from writing a 'me-too' application, i.e., one that has already been written. Second, and equally important, what you learn from your competitors' abstracts (and cataloging terms, if available) can be used to refine and improve your own research design. Most other writers of grant applications don't use these databases in the development of their applications. If you do, it will give you an important competitive edge.

3. Assess your idea's potential for funding. Even though you have probably already decided to submit your application to a specific Program at NSF, if you haven't done so already, you need to make certain that there aren't other, equally (or even more) applicable funding opportunities available to you. Grants.gov (http://www.grants.gov; see top of next page) is now the clearing house for all Federal granting opportunities. As such, it is an excellent place to search for other Federal sources of support.

Note that there is a tab at the upper left of the Grants.gov home page (above) that is titled "Find Grant Opportunities." Also note that, in addition to searching manually for sources of funding, you can subscribe to a free e-mail alert service that will notify you of future opportunities that match your research interests (see button on right under "For Applicants").

The Foundation Center Online (http://fconline.fdncenter.org/) is an excellent place to seek non-Federal sources of research-grant support.



While the Foundation Center is an excellent resource, its users must be either individual or institutional subscribers (https://fcsecure.fdncenter.org/fdo_signup_prof/register.php?setplan= start). If your institution isn't a subscriber and you don't want to make such an investment personally, try putting your key words, together with either the word 'grant' or 'funding' and then enter them into any good Internet search engine. You will be amazed at what can be unearthed with such an approach.

After you have completed your search, even if NSF continues to be your best bet for funding, other agencies that you have identified can become additional targets for applications. With competition what it is these days, not to send the same (or a very similar) application to multiple potential funding sources is almost unthinkable. It is usually not that much extra work to apply to more than one – and most agencies don't consider it to be a negative if you do so. For NSF all you have to do is acknowledge that you have done so in your application's *Current and Pending Support* section. There is one very important NSF exception, however. The Biological Sciences Directorate will not allow an *established* investigator to submit a research proposal to it if a duplicate (or very similar) proposal has been submitted for independent review to any other federal agency. However, those who qualify as beginning investigators (anyone who has not held a Federal research award as either principal or co-principal investigator) *can* submit the same /a similar application to the Biological Sciences Directorate and one or more other federal agencies simultaneously.

SEEK CONSTRUCTIVE CRITICISM FROM KNOWLEDGEABLE COLLEAGUES

Because the idea that underlies a grant application is so fundamentally important to its success, you need to do everything possible to ensure that it is as strong as you think it is. An essential part of 'doing everything possible' is seeking the critical feedback of knowledgeable colleagues; if problems exist with your idea, now is the time to find out about them — not later, from your reviewers. Once you have developed your idea to the fullest extent that you can, at least two persons should be consulted. They can either be at your own institution or at some other one. They could, for example, be members of the pre-submission review committee that you will ask to review the final draft of your application for scientific / technical merit before it is submitted (a process that is described in chapter 19 of this *Workbook*). You should present your idea in writing. To do so, once you have completed them we recommend that you give them the *Overview and Objectives* and *Expected Significance* sections of your application (see chapters 6 and 7). The two together constitute the 'master plan' or 'template' for your grant application.

The investigators to whom you show your overview should be chosen with several criteria in mind. First, they have to be ones in whom you have absolute trust, i.e., ones who you can be confident won't 'take the idea and run.' Second, it is essential that each of your consultants be intimately familiar with the field in which you have an interest. Otherwise, they will have difficulty assessing such things as novelty and potential impact. And, third, they have to be the kind of colleagues who can provide real, even painful, constructive criticism, should it be needed. With respect to this latter criterion, the kind of person you *don't* want is someone who would be afraid to hurt your feelings by pointing out a problem.

Critically consider the feedback that you receive from your colleagues and, *if you concur*, modify your idea to maximize its potential impact. If you don't fully concur, this can be a time of painful decision making. In such circumstances, you may want to seek the advice of additional colleagues before you make any changes. The bottom line is that you have to have total confidence that the final product — the idea that will drive your research proposal — is completely

sound and merits funding. If you don't, you won't be able to bring to your project the kind of enthusiasm and commitment that are necessary to write an outstanding application.

DEVELOPMENTAL STEPS FOR CHAPTER TWO:

1. Identify a relatively under-explored niche within the area of your broad research interest.
2. Identify the long-term goal you have within the niche area.
3. Conceptualize the step-by-step continuum of research that you would pursue to develop a research program in the niche area.
4. Identify the potential subject of the application you intend to write, i.e., the next logical step that needs to be taken along the continuum of research that you have just formulated.
5. Search and critically analyze the literature that is pertinent to the step you want to take.
6. While searching and analyzing the literature, develop a list of key words that are pertinent to the area and the names of investigators who have been active in the area during the last ten years.
7. Assess your own ability to pursue the idea, including such things as relevant expertise and resources.
8. Assess your competition and use information gleaned from databases of funded grants to improve your idea and the research design of your own proposal.
9. Assess which granting agencies are most appropriate to your idea, i.e., ones whose mission will be advanced by funding your idea.
10. Once you have brought the idea to the best level that you can, seek constructive criticism of it from knowledgeable colleagues. Use their feedback, if helpful, to maximize the idea's potential as the starting point for your application.