Outline of a Typical NSF Grant Proposal

Proposal Writing for Graduate Students - FISH 521

Modified from Theodore W. Pietsch

Title page (generated electronically by NSF's "FastLane" – in class, prepare your own)

Project summary (restricted to one single-spaced page)

Table of contents (generated electronically by NSF's "FastLane" – in class, prepare your own)

Project description (not to exceed 15 single-spaced pages – in class, limited to 10 pages)

    Introduction (historical review: what has been done? What remains to be done?)

    Objectives (concise statement of exactly what you want to do)

  Rationale and scope (why should the work be done? what specific problems will it resolve? include cooperating organizations and agencies, project participants and responsibilities, training, urgency, etc.)

    Research management plan (how will the work be done?)

        Sampling methods and protocols (how are you going to do it? include protocols for data acquisition, data analysis, dissemination of results, time-line, etc.)

        Available facilities (do you have the means to carry out the work? what provisions will be made to insure proper animal care?)

        Progress to date (what have you accomplished already? what remains to be done?

        Project schedule (when will you do what?)

        Immediate results (what answers will be immediately forthcoming?)

        Anticipated future research (what additional major research efforts will result)

    Contributions to education and human resources (will the work involve other graduate students, undergraduates? will it have an outreach component?)

    Intellectual merit and Broader Impacts

References or literature cited (length unlimited and not part of the 15-page limit)

Biographical sketch (limited to two single-spaced pages)

Proposed budget

Budget justification

Facilities, equipment, and other resources

Additional information/supplemental documentation (only if absolutely critical to the proposal; e.g., letters of concurrence and support from co-PIs and/or collaborators; copies of collecting permits and other permissions, etc.**)**

Appendices (currently not allowed by NSF without prior permission from a Program Director**)**

Project Summary

The proposal must contain a summary of the proposed activity suitable for publication, not more than one page in length. The project summary is the first thing that reviewers and NSF staff read. It should be written clearly and concisely. In the space allotted, it should outline the problem, the objectives and the expected outcomes, project activities, and the audience to be addressed. NSF Program Directors use the summary to choose reviewers for the proposal, thus you need to focus on the intended audience, and do all you can to generate excitement and enthusiasm for the work. If your project is funded, NSF will publish your summary (both in hard copy and electronically), thus it should reflect your very best effort. It should be informative to other persons working in the same or related fields and, insofar as possible, understandable to a scientifically or technically literate lay reader. The summary is a vital part of the proposal; considerable effort and thought should be directed toward its preparation.

The project summary should not be an abstract of the proposal, but rather a self-contained description of the activity that would result if the proposal were funded. It should be written in the third person and must clearly address in separate statements (within the one-page limit): (1) the **objectives and methods,** (2) the **intellectual merit** of the proposed activity, and (3) the **broader impact** resulting from the proposed activity. ***Proposals that do not separately address*** **"intellectual merit"** and "**broader impact"** ***within the one page Project Summary will be returned without review.***

Project Description

The **Project Description** contains the entire narrative of the proposal, excluding the Project Summary and Table of Contents, which come before; and the References or Literature Cited, the Proposed Budget, Budget Justification, etc., which follow. It must provide a clear statement of the work to be undertaken, including but not exclusive of the following: (1) an introduction; (2) a precise statement of objectives for the period of the proposed work; (3) the expected significance of the work; (4) relation to the longer-term research goals of the P.I.; and (5) relation to the present state of knowledge in the field to work in progress by the PI and to work in progress elsewhere. The Project Description is strictly limited to 15 single-spaced pages.

The **Project Description** should outline the general plan of the work, including the broad design of activities to be undertaken, and, where appropriate, provide a clear description of experimental methods and procedures and plans for preservation, documentation, and sharing of data, samples, physical collections, curriculum materials, and other related research and education products. It *must* describe, as an integral part of the narrative, the **intellectual merit** and **broader impacts** resulting from the proposed activities, addressing one or more of the following as appropriate for the project: how the project will integrate research and education by advancing discovery and understanding while at the same time promoting teaching, training, and learning; ways in which the proposed activity will broaden the participation of under-represented groups (e.g., gender, ethnicity, disability, geographic, etc.); how the project will enhance the infrastructure for research and/or education, such as facilities, instrumentation, networks, and partnerships; how the results of the project will be disseminated broadly to enhance scientific and technological understanding; and potential benefits of the proposed activity to society at large. Examples that illustrate activities likely to demonstrate broader impacts are available electronically on the NSF Website.

Not necessarily specific to the Description, but something to consider for the entire proposal, some

formatting considerations will help. Descending font sizes for headings and subheadings, and boldface and italicized type (but not underlined), if used judiciously, can help the reader grasp the textual flow, as can logical use of subheadings to break up the text. Subheadings also introduce some white space onto the page, improving appearance and ease of reading. **Esthetics is important**. A few figures here and there that summarize key findings can help to focus the message, break up the text a bit, and thereby impart interest as well as better explain crucial aspects of the work. But add illustrations, graphs, etc., sparingly. Be very careful to avoid the impression that you don't have enough to say and you're **filling the allowable space** (i.e., page limitation) instead with extraneous material.

Introduction and Objectives

The **Introduction** section of a grant or contract proposal (sometimes called the "Background," "**Background and Significance**," or something similar) should describe why a particular scientific question is important and sketch out the scope of knowledge to date (i.e., a brief **historical review**). This is probably the easiest place to bog down. Many investigators, especially inexperienced ones, are sure they will be considered deficient if they **do not cite and discuss every paper** ever published on their topic. You certainly want to let the reviewer know that you are aware of the **most pertinent and most recent work**, but sometimes this approach can backfire: it may appear that the investigator cannot distinguish which papers are most important and thus has quoted them all indiscriminately. Moreover, expert peer reviewers are already well versed in the research topic; they know the information and do not need to read it, while a not-so-familiar reviewer within another area of expertise probably lacks the time and interest to plow through five single-spaced pages of background and thus will not read it anyway. So, bottom line, be concise. Do your best to intrigue the reader, but not overwhelm. The writing should be well crafted and without jargon or an overly complicated structure (**avoid acronyms if you can**). The information should be carefully chosen and **up-to-date**. A brief summary paragraph that returns to the specific aims at the end works well with reviewers as a way to check if the argument is consistent with what has already been presented.

At a minimum, the **Objectives** section can be nothing more than a repeat of the objectives listed in the Proposal Summary, but in most cases you'll want to **expand somewhat on each**, that is, if space allows. If applicable, it's a good idea to separate the proposed work into short- and long-term goals, each stated in a precise and unambiguous way. For each objective or goal, ask yourself if it is reasonable (i.e., feasible) given the constraints of time, facilities, and money. Do they follow in **logical order**, each building on the one before? If at all possible, state your objectives in the form of **testable hypotheses**.

Rationale and Scope: The "Why" Questions

A narrative presentation of details that pertains to "Rational and Scope" should contain explanations for the following:

1. Why do the work? Why is it important? Why is it worth the time and expense?

2. How large is the project? What are the limits? Explain how and why it can be done within the timeframe allowed.

3. Why are you the best person to serve as project leader or principal investigator?

4. Are your co-workers (if any) up to the challenge? Who are they? What are their qualifications?

Explain why your group is ideally suited for the task(s) at hand.

5. What other organizations or agencies are involved? What will their contributions be and how will they add to the whole?

6. Is your laboratory the best place to do the work? Is it fully equipped to do the job?

7. Describe your study site(s). Where are they? How were they chosen? How was the number of sites chosen? Are there enough sites and will they be large enough? Why are they the best to accomplish the goals set for the research?

8. Preliminary Data: What planning has already taken place? Have you already visited and checked out your study sites? Is your research team already assembled? What can you say to ensure short- and long-term cooperation among participating individuals and agencies? Do you have all the necessary permissions, collecting permits, etc.? The importance of preliminary data varies among funding bodies, but the NSF is very keen on previous results. Essentially, you have to convince the reviewers and panelists that your project will produce results.

9. Urgency: is there some compelling need to get the work done now? How will the problem become worse if the research is postponed?

Research Management Plan: The "How" Questions

A narrative presentation that pertains to "Research Management Plan" should focus on how you plan to carry out the work. In general, it should contain explanations for the following:

1. **Sampling methods and protocols**: How will you collect samples? What sample sizes are you aiming for and why? Which methods will you use to collect samples?

2. **Animal care (if live animals are involved)**: Have you fulfilled all requirements mandated by the UW Institutional Animal Care and Use Committee? What provisions will be made to ensure proper animal care? Do your field and/or laboratory protocols fall within the accepted guidelines? Are you familiar with the various published guidelines for the use of vertebrates in field and laboratory research?

3. **Data acquisition:** How will you acquire the data (e.g. laboratory methods)? How will the data be recorded? How will the raw data be stored for future verification and accountability? What provisions will be made for establishing a specimen voucher system?

4. **Data analysis**: How will the data be analyzed? What statistical procedures will be used?

5. **Data interpretation:** How will your results be interpreted? How will they answer your questions and test your hypotheses?

6. **Dissemination of information**: How will the data and/or results be disseminated, i.e., made available to the scientific community? How will the results be made available to the lay community (e.g., a devoted website designed for students and/or the general public; a real-time satellite link between field activities and the Internet)?

7. **Facilities**:   What equipment and office and/or laboratory space do you already have at hand? What large, specialized equipment items do you need to do the job? What necessary equipment items will be provided by other participants or agencies? What equipment items will be purchased with grant funds? What big-ticket items will be purchased by the University in the form of matching funds? What accommodations will you provide to ensure essential comfort and safety of personnel in the lab and in the field? Don't spend too much space on this, as there is another section in the proposal specifically for available facilities (see outline on p 1). However, it is worth reiterating here any pertinent points.

8. **Project schedule**:   When will you do what? What precise time schedule will you follow? How much time will you allocate to data acquisition? How much time will you allocate to data analysis? How much time will you and/or your research team spend in the field versus time in the laboratory? What time restrictions are imposed by weather or animal life history? How much time will be set aside for the preparation of reports and manuscripts? It's usually worthwhile to include a flow chart or bar chart of planned activities.

Contributions to Education and Human Resources

If at all possible, you should try to include narrative that pertains to the following:

1. How does the proposed activity foster the integration of research and education? One of the principal goals of granting agencies is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities for individuals to assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

How will your work contribute to education and human resources? Will you provide opportunities for post-doctoral students, graduate students, and/or undergraduates? Will there be an outreach component? Will you develop a devoted Internet set that describes the work and its results while at the same time serving to educate the public?

Are there any "value added" components to the research? Are there any other contributions to society (local, regional, national, or global) that take the proposal beyond the average everyday request? Are there any political ramifications? How does the research relate to the average person on the street, i.e., the taxpayer?

Explain in each case how these things will be accomplished, while being careful to maintain focus on the goals set for the project.

2. How does the proposed activity broaden opportunities and enhance diversity? Broadening opportunities and enabling the participation of all citizens, women and men, underrepresented minorities, and persons with disabilities, are essential to the health and vitality of science. Many granting agencies are committed to this principle of diversity and deem it central to the programs,

projects, and activities they consider and support.

What special efforts will you make to include underrepresented minorities and persons with disabilities in your research? What efforts will you make to extend educational opportunities to underrepresented minorities and persons with disabilities?

Intellectual Merit and Broader Impacts

In making funding decisions and recommendations, reviewers and review panels pay particular attention to two primary criteria, both of which *must* be addressed in your one-page project summary and fully described and expanded at the end of the proposal:

What is the intellectual merit of the proposed activity?

1. How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields?
2. How well qualified is the proposer (individual or team) to conduct the project?
3. To what extent does the proposed activity suggest and explore creative and original concepts?
4. How well conceived and organized is the proposed activity?
5. Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

1. How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
2. How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
3. To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?
4. Will the results be disseminated broadly to enhance scientific and technological understanding?
5. What may be the benefits of the proposed activity to society?