The Original How to Write a Research Grant Application

Contents

Strategy for Getting an NIH Grant

1. Assess competition in the field.

2. Know the level of resources needed to compete.

    - do an organizational assessment.

    - look for opportunities to build research with support from various sources.

    - get a mentor.

3. Be willing to change yourself, your projects, your career.

4. Know the opportunities in the field for

    - collaboration with a known laboratory or mentor

    - carving out a niche

5. Find out which NIH institutes supporting research in your area are seeking applications.

    - go to our list of program announcements (PA) on the Web at **http://www.niaid.nih.gov/ncn/pa-table.htm** and requests for applications (RFA) at **http://www.niaid.nih.gov/ncn/rfa-new.htm**.

    - discuss your ideas with Institute program staff. NIAID's program and staff listing is online at **http://www.niaid.nih.gov/ncn/staff/p-and-s.htm**.

6. Make sure you and your collaborators are properly trained for the research.

7. Closely examine grant applications from successful grantees.

8. Read the instructions in the grant application kit (PHS 398), then read them again. Follow them to the letter.

9. Have several experienced grantees critique your application.

10. Consider requesting NIH to refer your application to a study section that has a high level of interest and expertise in your research topic.

Writing an Application for a Research Project Grant

There are several components to a strong grant application. First, the subject must be creative, exciting, and worthy of funding. Then, the project must be developed through a rigorous, well-defined experimental plan. Finally, you must make sure that the information is presented in clear language and that your application follows the rules and guidelines detailed in the grant application kit, PHS 398, which is on the Web at **http://www.nih.gov/grants/funding/phs398/ phs398.html**.

This document will help you make sure your application for a research project grant (R01) addresses the key questions reviewers ask.

Eight Basic Questions Reviewers Ask

1. How high are the intellectual quality and merit of the study?

2. What is its potential impact?

3. How novel is the proposal? If not novel, to what extent does potential impact overcome this lack? Is the research likely to produce new data and concepts or confirm existing hypotheses?

4. Is the hypothesis valid and have you presented evidence supporting it?

5. Are the aims logical?

6. Are the procedures appropriate, adequate, and feasible for the research?

7. Are the investigators qualified? Have they shown competence, credentials, and experience?

8. Are the facilities adequate and the environment conducive to the research?

Writing a grant application is a major undertaking. Below is advice from experienced NIH staff to help you succeed.

Please note that this document does not repeat instructions in the PHS 398 (version 4/98) application kit.

A NOTE ON MECHANISM: Though the advice we provide is relevant for all research grants, it is geared toward the research project (R01). For additional advice on other mechanisms, contact an NIH program administrator (see our listing of NIAID programs and staff at **http:// www.niaid.nih.gov/ncn/staff/p-and-s.htm**) or NIAID's Scientific Review Program at 301/496-2550.

Further, when applying for a grant in response to a request for applications or a program announcement, carefully read the review criteria and any special instructions before preparing the application.

I. Before You Begin

Before you start writing the application, make sure you've done your homework: know the field, choose an excellent idea to pursue, and equally important, read the entire grant application kit (PHS 398) very carefully. This document does *not* repeat instructions contained in PHS 398.

Begin by focusing on the big picture. It is critical that you are intimately familiar with the field in which you are considering applying to NIH for funding. You must be aware of the field's directions, knowledge gaps, and research already being done. Your application will be reviewed by your peers, investigators who are knowledgeable about the research area of your proposal.

To succeed, you will have to be at least as knowledgeable as they are. Consider the reviewers to be "informed strangers." You must include enough detail to convince them your hypothesis is sound and important, your aims are logical and feasible, you understand potential problems, and you can properly analyze the data.

Developing the Hypothesis

Most reviewers feel that a good grant application is driven by a strong hypothesis. The hypothesis is the foundation of your application. Make sure it's solid. It must be important to the field, and you must have a means of testing it.

Provide a rationale for the hypothesis. Make sure it's based on current scientific literature. Consider alternative hypotheses. Your research plan will explain why you chose the one you selected.

A good hypothesis should increase understanding of normal biologic processes, diseases, or treatments or preventions.

Your proposal should be driven by one or more hypotheses, not by advances in technology (i.e., it should not be a method in search of a problem). Also, avoid proposing a "fishing expedition" that lacks solid scientific basis.

State your hypothesis in both the specific aims section of the research plan and the abstract.

II. Application Contents

Before you start writing, carefully read PHS 398, *Application for a Public Health Service Grant.*

Please note changes made as a result of modular grants (sections with asterisks below). Go to the NIH modular grants and applications Web page at **http://www.nih.gov/grants/funding/modular/modular.htm** and the notice in the *NIH Guide for Grants and Contracts* at **http://www.nih.gov/grants/guide/notice-files/not98-178.html** for more information.

Also, see the budget section on page 12 for more information.

The PHS 398 grant application kit gives you information and guidance on these sections of the application:

Face page

Description (abstract)

Performance sites

Key personnel

Table of contents

* Detailed budget for initial budget period

* Budget for entire proposed period of support

**Biographical Sketch

** Other support

Resources

Research Plan

Appendix

Checklist

Personnel report

Personal data

* Not needed for modular grants and applications, which applies to most types (listed on the bottom of page 14) requesting up to $250,000 in direct costs.

** Changed as a result of modular grants; see Internet address above and the article in January Council issue of NIAID *Council News*, What's Different About Modular Grants at **http://www.niaid.nih.gov/ncn/nl0199/page2.htm**.

Below we outline the sections of the PHS 398 (4/98) in the order in which you would likely develop them. As the biggest and most important part of your application upon which the rest hinges, the research plan is a good place to begin.

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III. Developing Your Research Plan

A top-quality research plan is the most important factor determining your application's success in peer review. As with a scientific publication, developing your ideas is key. Read the PHS 398 grant application kit carefully for specific elements to be included in the research plan.

Before we go into specific sections of the plan, here are some general tips:

- Your application should be based on a strong hypothesis.

- Be sure your project has a coherent direction.

- Keep the sections of the plan well coordinated and clearly related to the central focus.

- Emphasize **mechanism:** A good grant application asks questions about biological mechanisms.

- Don't be overly ambitious—your plan should be based on a feasible timetable.

- Specific aims and experiments should relate directly to the hypothesis to be tested.

A. Specific Aims

Your specific aims are the objectives of your research project, what you want to accomplish. The project aims should be driven by the hypothesis you set out to test. Make sure they are highly focused.

Begin this section by stating the general purpose or major objectives of your research. Be sure that all objectives relate directly to the hypothesis you are setting out to test. If you have more than one hypothesis, state specific aims for each one. Keep in mind that your research methods will relate directly to the aims you have described.

State alternatives to your hypothesis and explain why you chose the one (or more) you selected.

Choose objectives that can be easily assessed by the review committee. Do not confuse specific aims with long-term goals.

B. Background and Significance

Keep the statement of significance brief. State how your research is innovative, how your proposal looks at a topic from a fresh point of view or develops or improves technology.

Show how the hypothesis and research will increase knowledge in the field. Relate them to the longer-term, big picture scientific objectives and to the betterment of public health.

Justify your proposal with background information about the research field that led to the research you are proposing. The literature section is very important because it shows reviewers that you understand the field and have a balanced and adequate knowledge of it.

Use this opportunity to reveal that you are aware of gaps or discrepancies in the field. Show familiarity with unpublished work, gained through personal contacts, as well.

Identify the next logical stage of research beyond your current application.

C. Preliminary Studies/Progress Report

By providing preliminary data, this extremely important section helps build reviewers' confidence that you can handle the technologies, understand the methods, and interpret results.

Preliminary data should support the hypothesis to be tested and the feasibility of the project.

Explain how the preliminary results are valid and how early studies will be expanded in scope or size.

Make sure you interpret results critically. Showing alternative meanings indicates that you've thought the problem through and will be able to meet future challenges.

Preliminary data may consist of your own publications, publications of others, unpublished data from your own laboratory or from others, or some combination of these.

Include manuscripts submitted for publication. Make sure it's clear which data are yours and which were reported by others.

D. Research Design and Methods

Describe the experimental design and procedures in detail and give a rationale for their use.

Organize this section so each experiment or set of experiments corresponds to one of your specific aims and is stated in the same order. Even holding to this structure, the experiments still must follow a logical sequence. They must have a clear direction or priority, i.e., the experiments should follow from one another and have a clear starting or finishing point.

Convince reviewers that the methods you chose are appropriate to your specific aims, that you are familiar with them, and that, unless innovative, they are well established. If your methods are innovative, show how you have changed existing, proven methods while avoiding technical problems. Also, describe why the new methods are advantageous to the research you propose to do.

More and more applicants are including colored charts, graphs, and photographs in their applications. If you must use color to get your point across, it is wise to also place a copy of the item in an appendix, noting this in the body of the text. Many applicants are not aware that **reviewers receive only black and white photocopies of their original application.** However, assigned reviewers do receive **originals** of the **appendices** (which is why we ask for five copies).

Approach(es)

State why you chose your approach(es) as opposed to others.

If you are choosing a nonstandard approach, explain why it is more advantageous than a conventional one. Ask yourself whether the innovative procedures are feasible and within your competence.

Call attention to potential difficulties you may encounter with each approach. Reviewers will be aware of possible problems; convince them you can handle such circumstances. Propose alternatives that would circumvent potential limitations.

Consider the limitations of each approach and how it may affect your results and the data generated.

Spell it out in detail. While you may assume reviewers are experts in the field and familiar with current methodology, they will not make the same assumption about you. It is not sufficient to state, "We will grow a variety of viruses in cells using standard *in vitro* tissue culture techniques." Reviewers want to know which viruses, cells, and techniques; the rationale for using the particular system; and exactly how the techniques will be used. Details show you understand and can handle the research.

Make sure any proposed model systems are appropriate to address the research questions and are highly relevant to the medical problem being modeled.

Results

Show that you are aware of the limits to— and value of—the kinds of results you can expect based on current knowledge of the subject. State the conditions under which the data would support or contradict the hypothesis and the limits you will observe in interpreting the results.

Show reviewers you will be able to interpret your results by revealing your understanding of the complexities of the subject.

Many applications benefit from statistical analysis. The early involvement of a statistician to determine the amount of data to collect and the methods for analyses will favorably impress reviewers. Describe your proposed statistical methods for analyzing the data you plan to collect.

Define the criteria for evaluating the success or failure of a specific test.

Other pointers

Read the PHS 398 carefully for specific requirements, especially those involving human subjects.

Estimate how much you expect to accomplish each year of the grant and state any potential delays you can anticipate.

Describe sources of reagents, animals or equipment not generally available. If collaborators will provide them, include letters from the sources in your application.

Describe any procedures, situations, or materials that may be hazardous and precautions you will take.

Include supporting data. Where appropriate, include well-designed tables and figures. Use titles that are accurate and informative. Label the axes and include legends. Reviewers will look for discrepancies between your data and text.

Include relevant publications. If you (or your collaborators) have publications showing your use of the proposed methods, put them in the appendix.

E. Human Subjects

Assuring NIH that human subjects are protected is a key responsibility of the applicant, in concert with the applicant's institution. Awards cannot be made until assurances are on file here.

If your proposed research does not involve human subjects, indicate this by noting "Not applicable" in this section of the 398. Anyone reading your application then will know immediately that you have not just forgotten to complete this section.

If your proposed research involves human subjects or samples from human subjects, read the Assurances and Certifications sections of the 398 carefully.

Your application should provide information on these items, if applicable to your project:

- Characteristics of the subjects. Ensure adequate and appropriate representation of minorities and both genders—any exclusions must be justified.

- Sources of research materials.

- Recruitment plans and consent procedures.

- Potential risks.

- Procedures for protecting against or minimizing potential risks to human subjects.

- Potential benefits to the subjects and to mankind.

Include enough information so reviewers have no questions about what you propose to do.

In addition, your research plan must be certified by your institution's institutional review board (IRB) prior to funding (unless exempt). Though IRB approval is not required at the time of application, you should start the process early because revisions and final approval can take time.

Before an application is funded, you **must** file an Assurance of Compliance with the Office for Protection from Research Risks (OPRR). Call OPRR at (301) 496-7041 or your institution's grant or contracts office for details and help.

F. Vertebrate Animals

As with human subjects, applicants must also provide assurances that research animals are treated properly. Awards cannot be made until NIH receives this information. When preparing your application, read the Assurances and Certifications sections of the PHS 398 carefully.

Your application should include:

- A detailed description of the proposed use of the animals.

- A justification for the choice of species and number of animals to be used (describe any statistical methodology used for this determination).

- Information on the veterinary care of the animals.

- An explanation of procedures to ensure that the animals will not experience unnecessary discomfort, distress, pain, or injury.

- Justification for any euthanasia method to be used.

If the proposed research involves vertebrate animals, your project must be reviewed and approved by an institutional animal care and use committee prior to funding. For more information, call OPRR (see above) or your institute's grant or contracts office.

G. Literature Cited

Refer to the literature thoroughly and thoughtfully but not to excess. The publications you cite need not be exhaustive but should include those most relevant to your proposed research.

Research proposals typically do not fare well when applicants fail to reference relevant published

research, particularly if it indicates that the proposed approach has already been attempted or the methods found to be inappropriate for answering the questions posed.

Each citation must include the names of all authors (not *et al.*), name of the book or journal, volume number, page numbers (not first page only), and year of publication.

H. Consortium/Contractual Arrangements

This section should briefly describe any consortium and contractual arrangements you have made with regard to the proposed research plan.

The roles of individuals or organizations with whom you have made such arrangements should be noted and reference made to any letters from them that are included in the application. Letters should describe the individual's or organization's understanding of the consortium or contractual arrangements.

I. Consultants

Careful selection and addition of consultants can add credibility to your application and greatly improve its quality. A letter describing the willingness of an investigator to participate as a consultant to your project should be included in your application.

IV. Application Contents Other Than the Research Plan

Congratulations, you have completed the hardest part of your application, the research plan. Now, you're ready to work on the other parts.

Keep in mind that some required information is changing. Notices in the *NIH Guide,* **http://www.nih.gov/grants/guide/index.html**, and articles in the *Council News* newsletter, **http://www.niaid.nih.gov/ncn/news.htm**, will have the latest changes, the most recent and important of which is the switch to a modular format for most grants. For additional information on modular grants and applications, go to NIH's Web page, **http://www.nih.gov/grants/funding/modular/modular.htm**, and the *Guide* notice, **http://www.nih.gov/grants/guide/notice-files/not98-178.html**.

Abstract (Form BB)

Write this carefully because the NIH referral officer depends heavily on the abstract and title to assign your application to a peer review panel and to an IC (Institute or Center) for award. Clarity will also help direct your application to the most appropriate primary reviewers and may encourage other reviewers in the study section to read it.

Write your abstract **after** you have finished your research plan. Make it a clear, succinct summary of your project within the 200-word limit. It should state your hypothesis, objectives, why the objectives are important and innovative, and plans and methods for accomplishing your goals.

Title

Make your title specific and detailed. If your application is a revision, do **NOT** change the title.

Stay within the 56-character limitation (this includes spaces between words).

Biographical Sketches (Form FF)

This section is your chance to showcase the knowledge, skills, and abilities of the key staff and consultants involved in your project. Reviewers are concerned that the investigators and proposed staff have the proper experience with the proposed techniques. They look carefully at the biosketches.

With the advent of the modular grant and application, the information in biosketches has changed. Because other support is postponed until just before an award is made, the biosketch section should include the aims of all past and current related research of key personnel as well as related publications. Further, the page limit is now three pages.

Beginning with the principal investigator, include the following for each key professional listed on Form BB of the 398:

- Name and title.
- Education—institutions, location, degree(s), year conferred, and field(s) of study.
- Roles in other relevant current or past research.

- Employment history in *reverse* chronological order— dates, places, nature of position, professional experience, honors. List only relevant publications in chronological order, titles and complete references (include all authors).
- List all staff, professional and nonprofessional, even when not requesting salary. Reviewers appreciate your giving estimates of the effort (not salary) for each person.

Budget

Reviewers evaluate a requested budget for whether it is realistic and justified by the aims and methods of the project. Complete the budget section after you have written your research plan and have a good idea of costs.

Request only enough money to do the work. Significant over- or underestimating suggests that you may not understand the scope of the proposed work. Avoid requesting expensive equipment unless you absolutely need it, and justify it well. Don't request funds for equipment that is already listed in the resources section, unless you can provide an adequate explanation. Reviewers look for any "discrepancies" and will delete funds for equipment that should be available to you.

Also, make sure you calculate the salary of the principal investigator (PI), taking into account the government cap of $125,900.

Modular grants

NIH's adoption of the modular approach for most grant types involves changes to the application's budget section. Prepare a modular grant application if you are requesting $250,000 a year or less for direct costs (more expensive applications are nonmodular) for the grant types listed on the bottom of page 14.

Request monies in $25,000 modules. Generally, you request the same number of modules each year except for special needs, such as equipment.

Modular changes are not reflected in the PHS 398 April 98 edition, and therefore **you do not use the budget form pages**. Go the NIH modular Web site at **http://www.nih.gov/grants/funding/modular/modular.htm** for sample modular budget pages. And check the *NIH Guide* for future changes.

NB: Be sure to build any funding increases you foresee into the request. Under the modular system, there is no routine funding escalation for future years. **You must plan for the cost of the entire project when applying.** This is a major departure from the traditional process, in which grantees received inflation-based annual budget increases.

Resources

The resources section is a critical part of your application. Show reviewers that you have the necessary equipment, space, support staff, and other facilities to conduct the research. Don't assume that reviewers know your facilities have gas, vacuum, centrifuges, scintillation counters, gel apparatus, computers, autoclaves, shop, animal facilities, secretarial and financial support, or anything else you need for your research.

V. Writing and Formatting

Read PHS 398 carefully and follow its guidelines to the letter. Formatting is strictly enforced. Don't risk having your application returned because you exceeded the page limits or used an improper font or font size.

Edit thoroughly. Make sure your work is letter perfect. If you cannot meet the application deadline comfortably, consider delaying to the next receipt date.

Follow the format in the instructions. Reviewers expect the research plan to be organized exactly as described in the instructions—you do not want to upset these expectations! Label sections exactly as in the instructions: A. Specific Aims, B. Background and significance, etc.

Conduct your own peer review—get outside opinions. Find colleagues in your field who are experienced and successful grant writers and preferably reviewers (members or former members of NIH study sections). The more critical they are, the better. It's better to know the problems before you send in your application than learn about them after the review when your grant gets an unfundable score.

Page Limitations

Observe the page limitations for your type of application; further, reviewers appreciate comprehensive but succinct proposals. Only the sections of the Research Plan count toward the page limit.

Type (font) Size and Spacing

Type setting (font size and spacing) requirements are strictly enforced. Avoid alienating reviewers with hard-to-read type. These are the minimum specifications:

10-point font size is the minimum allowed, but your application may be better received with 11- or 12-point font.

Density of letters must not average more than 15 characters per inch though fewer may be better.

Do not squeeze lines together; no more than 6 lines per vertical inch are allowed.

Font size in figures and tables may be smaller but must be readily legible.

Writing Tips

Use the active rather than passive voice. For example, write "We will develop a cell line," not "A cell line will be developed."

Keep related ideas and information together, e.g., put clauses and phrases as close as possible to — preferably right after—the words they modify.

Simplify and breakup long, involved sentences and paragraphs. In general, use short simple sentences; they are much easier on the reader. Your goal is communication, not literature.

Edit out redundant words and phrases. Edit and proofread thoroughly. Look carefully for typographical and grammatical mistakes, omitted information, and errors in figures and tables. Sloppy work will definitely suffer in review. Reviewers feel that if the application is sloppy or disorganized, the applicant's research may be as well.

VI. Submitting Your Grant Application

Receipt Date

NIH receipt dates have been changed so the post mark on the application now counts as the date for meeting the deadline. Go to the Review, Receipt, and Award Table (**http://www.nih.gov/ grants/funding/submissionschedule.htm**) for receipt dates for various types of grant applications.

Cover Letter

It's a good idea to include a cover letter with your application. The letter should state the title of the application, very briefly describe the focus of the research proposed and, if applicable, identify the program announcement (PA) or request for applications (RFA) to which you are responding. In addition, you may include the names of people whom you feel should not be allowed to evaluate your application (the section on Review of Applications on page 17 discusses this subject in more detail).

Requesting an SRG and Institute/Center

Your cover letter can and often should request that your application be reviewed by a specific Scientific Review Group (SRG), administered by a specific Institute or Center, or both (see page 16 for more information). NIH usually accommodates these requests but reserves the right to make the final decision.

You can discuss referral decisions with the CSR Referral Office at 301/435-0715 as well as with the assigned SRA after referral to an SRG has been made. At least the first time through, you should probably let the NIH referral system decide which SRG will review your application. NIH referral staff are correct the vast majority of the time.

Modular Grants and Applications and Just in Time

The move to modular grants and applications extends NIH's just-in-time (JIT) processes, which postpone your sending in certain information when submitting a grant application until an award is likely, decreasing the paper burden on you and your institution.

The modular approach is being used for research project grants (R01), small grants (R03), academic research enhancement awards (R15), exploratory or experimental grants (R21), small business technology transfer phase I (R41), and small business innovation research phase I (R43) grants as well as competing supplements and applications responding to RFAs.

For initiatives such as RFAs and program announcements, you will need to refer to individual solicitations (and also what NIH calls "notices") in the *NIH Guide* for specific instructions.

JIT is used for career awards (K), which do not follow modular procedures.

VII. Problems and Concerns Commonly Cited by Reviewers

Below is a list of the most common reasons cited by reviewers for an application's lack of success:

Lack of significance to the scientific issue being addressed.

Lack of original or new ideas.

Proposal of an unrealistically large amount of work (i.e., an overambitious research plan).

Scientific rationale not valid.

Project too diffuse or superficial or lacks focus.

Proposed project a fishing expedition lacking solid scientific basis (i.e., no basic scientific question being addressed).

Studies based on a shaky hypothesis or on shaky data, or alternative hypotheses not considered.

Proposed experiments simply descriptive and do not test a specific hypothesis.

The proposal is technology driven rather than hypothesis driven (i.e., a method in search of a problem).

Rationale for experiments not provided (why important, or how relevant to the hypothesis).

Direction or sense of priority not clearly defined, i.e., the experiments do not follow from one another, and lack a clear starting or finishing point.

Lack of alternative methodological approaches in case the primary approach does not work out.

Insufficient methodological detail to convince reviewers the investigator knows what he or she is doing (no recognition of potential problems and pitfalls).

Most experiments depend on success of an initial proposed experiment (so all remaining experiments may be worthless if the first is not successful).

The proposed model system is not appropriate to address the proposed questions (i.e., proposing to study T-cell gene expression in a B-cell line).

The proposed experiments do not include all relevant controls.

Proposal innovative but lacking enough preliminary data.

Preliminary data do not support the feasibility of the project or the hypothesis.

Investigator does not have experience (i.e., publications or appropriate preliminary data) with the proposed techniques or has not recruited a collaborator who does.

The proposal lacks critical literature references causing reviewers to think that the applicant either does not know the literature or has purposely neglected critical published material.

Not clear which data were obtained by the investigator and which have been reported by others.

VIII. Referral and Assignment of the Application

When NIH receives an application, two things happen. First, it ***referred*** to a scientific review group (SRG) for review, and second, it is ***assigned*** to an institute or center for possible funding. These steps are very important to the fate of a grant application.

Competition for funding often varies among ICs, so assignment choices may determine whether your application is funded.

Please be aware that you have the right to request the referral and assignment of your application to the organizations you feel would serve it best. NIH data show that applicants can successfully self-assign and self-refer to an SRG and institute.

Much of the information you need to know to do this is available, and the rest you can get by calling program administrators in NIAID (see program and staff listing at **http://www.niaid.nih.gov/ncn/staff/p-and-s.htm**) or in other institutes (see the NIH home page at **http://www.nih.gov.**)

Information about which scientific areas the various SRGs of the Center for Scientific Review (CSR) handle is invaluable. It is readily available either on the web, at **http://www.drg.nih.gov/review/irgdesc.htm**, from most institutions, or from the CSR Grants Office, 301/435-0714. You can also find lists of study section members on the web; go to **http://www.drg.nih.gov/commit-tees/rosterindex.asp**.

To discuss referral decisions with the CSR referral office, call 301/435-0715; you can also call the SRA in charge of the review.

You should also discuss your project with a program officer of the institute that supports your area of research before requesting assignment to an IC. You can request primary and secondary assignments in your cover letter.

If you do not self-assign, a referral officer in the NIH Center for Scientific Review forwards your application to an SRG and NIH institute or center (IC) based on NIH referral guidelines. The referral officer may also make secondary assignments to other ICs that may be interested in funding the application.

IX. Review of Research Project Applications

This section describes what happens to grant applications during initial peer review. Your application can be reviewed in one of two places, either in NIH's Center for Scientific Review (CSR) or in an institute.

Scientific Review Groups

Whereas most investigator-initiated applications are reviewed by a scientific review group (SRG, a.k.a. study section) in CSR, institute SRGs review applications and proposals that address institute-specific needs. These are typically program projects (P), cooperative agreements (U), training (T) and research career (K) grants, and applications responding to requests for applications and requests for proposals.

Both in CSR and institutes, chartered SRGs are composed of scientists who have a broad range of scientific expertise in a general area. Most SRGs in CSR meet three times a year for one to three days. All SRGs are managed by an institute or CSR scientific review administrator (SRA).

Review Criteria

In June 1997, NIH established new review rating criteria, the factors reviewers weigh when assessing the merit of an application. The following criteria are used by all NIH SRGs for the initial peer review of research project grant applications:

Significance

Approach

Innovation

Investigator

Environment

To read more about peer review issues and policies, go to **http://www.nih.gov/grants/peer/peer.htm**. Your Institute program and review staff are also good sources of information.

Cover Letter

Your application can include a cover letter in which you can identify people who **should not** review your application because of potential conflict of interest (e.g., someone who is a competitor or with whom you have a long-standing scientific disagreement).

State the reasons for your objections to specific reviewers. This strategy may be useful when you submit a revised application and you believe there is a problem with a reviewer from the previous review. Go to page 22 for more information on revising an application.

Administrative Review

Before sending applications to members of a peer review panel, SRAs examine the administrative components of the applications. When an applicant has not provided certain required information (such as a biographical sketch for a key investigator), the SRA has the option of contacting the applicant to request the missing information.

If you receive such a request, consider it an opportunity to strengthen your application. A rapid response will ensure that peer reviewers receive the additional information in time to fully consider it prior to the review meeting.

At the Peer Review Meeting

Four to six weeks before an SRG meets, the SRA sends each SRG member a copy of the applications to be reviewed.

Usually, the SRA assigns at least two members to be primary reviewers and write critiques before the meeting. The SRA will also ask one or more members to serve as readers, who identify strengths and weaknesses of applications. Other SRG members may or may not read the application prior to the review.

How Priority Scores Are Determined

If your application warrants a full discussion at the review meeting (see below for reasons it may not), reviewers present their evaluations and indicate their level of enthusiasm by suggesting a priority score, where 1.0 is the best and 5.0 is the worst.

Your application is then opened for discussion, and differences of opinion are explored. Then, study section members each assign a score. The priority score on your summary statement is the average of the individual scores multiplied by 100.

Applications that lack substantial scientific merit or lack information do not receive a priority score.

Three categories of applications do not receive a full review, a priority score, and a full summary statement:

1. Unscored—Refers to applications whose merit is judged to be in the bottom half of the group of applications (priority scores between 3.0 and 5.0) being reviewed by a scientific review group. (Under NIH's streamlined review, applications are subjected to a preliminary evaluation to determine their scientific merit relative to that of the group of applications under review.) Applications judged to be in the lower half are not subject to full discussion and are not scored. The applicant receives the assigned reviewers' critiques and a resume of the discussion.

2. Not Recommended For Further Consideration (NRFC)—Used for applications found to have no significant and substantial scientific merit. In addition, applications that include clinical research with inadequate protection against risks to human subjects can be classified in this category.

3. Deferred—In some instances, the scientific review group is unable to make an adequate determination of the scientific merit of an application due to lack of adequate information. In such cases, the group can ask that the application be deferred, generally to a later review date, to allow additional time to obtain the information from the applicant, either by telephone or by the submission of additional material (or, in some cases, a site visit or an outside opinion). Deferred applications are ordinarily reviewed during the next review cycle. Occasionally, a deferred application can be reconsidered later in the same meeting, if the information can be obtained by calling the applicant.

Summary Statements

Prepared by the SRA, summary statements include the reviewers' critiques (as feedback applicants may use to revise their applications), a summary of the deliberations, an average priority score, recommended changes in the budget, and administrative comments, if any. The roster included with the summary statement lists the reviewers but does not identify which were assigned reviewers (this is done to protect confidentiality).

Institutes mail summary statements to applicants roughly six to eight weeks after the SRG meeting and provide them to the program staff member responsible for the application. It's a good idea to wait until after you receive and review your summary statement before calling your program officer to learn if your application is likely to be funded.

Appeal

You can appeal a review if you feel ***the review process*** was seriously flawed. Flawed means errors due to reasons such as conflict of interest or bias. Differences in scientific opinion cannot be appealed.

If you believe appealable errors occurred, talk with your program officer to discuss your best course of action (for a listing of NIAID programs and staff, go to **http://www.niaid.nih.gov/ncn/ staff/p-and-s.htm**.) For more information about the NIH appeals process, go to the *Guide* notice at **http://www.nih.gov/grants/guide/1997/97.11.21/n2.html** and to our newsletter article at **http://www.niaid.nih.gov/ncn/nl0997/page2.htm.**

X. How Funding Is Decided

Several factors come into play when NIH institutes and centers (IC) decide which applications to fund.

Paramount among them is an application's percentile ranking derived from its priority score, the outcome of peer review. In addition, an IC considers the relevance of the proposed project to its mission and the availability of funds.

How Paylines Work

Some ICs, such as NIAID, set a payline, which is a funding cutoff point. This means that NIAID funds all applications with percentiles better than the payline, whereas those worse than the payline (with the exception of some high-priority applications at the payline margin) are not funded or funding is deferred until later in the fiscal year.

Several things are important to know about paylines. One is that the payline is a budget management tool. It may change as the fiscal year progresses and the precise amount of funds available to the Institute becomes better known (for a more in-depth discussion of paylines and percentiling, see our newsletter article at **http://www.niaid.nih.gov/ncn/nl0199/page6.htm**). Second, many more grants get funded than those within the payline. What is often referred to as "the payline" is actually the payline for R01 grants only. Other types of awards, including training and bridge awards are not affected by the R01 payline and do not affect it.

Third, paylines vary among ICs. So a percentile that is not fundable in one institute may be fundable in another. That's why the assignment of your application is so important.

You can improve your likelihood of gaining funding by requesting that your application receive primary or secondary assignment (see page 16) to an IC seeking applications in your research area (for NIAID's program areas, see the program and staff listing at **http://www.niaid.nih.gov/ncn/staff/p-and-s.htm**). We also list NIAID's concepts on the web, at **http://www.niaid.nih.gov/ncn/in-main.htm**, to give you insights into the Institute's high priority areas.

For more information about requesting assignment to an IC, contact the CSR referral office at 301/435-0715.

Second Level Peer Review

In the NIH peer review process, applications undergo a second level of peer review. At NIAID, this is carried out by the Institute's advisory Council. Council members look at summary statements of grants within the payline, especially for applications with special concerns, such as human subject issues.

They also consider a small number of high-priority grants at the payline margin that will be paid selectively. Council may also consider complaints or other information from applicants regarding the quality of the review.

Possible Outcomes of Secondary Review

Following Council review, NIAID takes one of four actions for an application:

1. Approved for funding.

2. Primary responsibility transferred to another IC that agrees to fund it.

3. Kept active for later decision, usually at the end of the fiscal year.

4. Not funded; file is closed.

Why Applications Are Kept on Hold

ICs disperse funds by fiscal year (October 1 through September 30). Payment of too many applications following the first (September/October) or second (January/February) review cycles in the fiscal year could preclude payment of better applications later.

Thus, early in the fiscal year, ICs usually fund only applications highly likely to rank in the fundable range for all applications received for the year. Typically, they defer decisions for borderline applications until after the third review cycle in June or July. If funds are still available, ICs may then fund these still active but unfunded applications in percentile order.

XI. When You Have Not Obtained Funding

What if you submit a grant application and it does not get funded? Competition for NIH funds has become increasingly tough, and it is common not to succeed at the first attempt. Be prepared to revise and resubmit your application.

Be persistent! Data show that over half of all NIH applicants eventually get funded. Revising the application is your opportunity to address reviewers' concerns. Many applications succeed on the second or even third submission (the limit is three).

*Most Common Reasons for a Low Score (in priority order)**

- Lack of new or original ideas.
- Hypothesis ill-defined, superficial, lacking, unfocused, or unsupported by preliminary data.
- Methods unsuitable or defective and not likely to yield results.
- Data collection confused in design, inappropriate instrumentation, poor timing or conditions.
- Data management and analysis vague, unsophisticated.
- Inadequate expertise or knowledge of field for PI, or too little time to devote to the work.
- Poor resources or facilities; limited access to appropriate patient population.

   *From "Why clinical research grant applications fare poorly in review and how to recover."
      Cuca JM; McLoughlin WJ, Cancer Invest 1987;5(1):55-8.

When to Revise

How do you know when to revise your application and resubmit or when to begin over with a new idea? If reviewers thought your basic idea was interesting and important, the application may be worth revising. However, if they felt the hypothesis was weak, begin with a new idea.

If the problems are repairable, revise the application and resubmit it to the same study section.

Common fixable problems

- Poor writing.
- Insufficient information, experimental details, or preliminary data.
- Significance not convincingly stated.
- Research not shown to be feasible by the proposed staff.
- Insufficient discussion of obstacles and alternatives approaches.

Not fixable or more difficult problems

- Philosophical issues, e.g., the reviewers believe the work is not significant.
- Hypothesis is not sound or not supported by data presented.
- Work has already been done.
- Methods proposed were not suitable for testing the hypothesis.

- Suitable expertise was not available on the SRG that reviewed your grant.
- Perceived bias (Bias is rare. Reviewers will be alert to bias and argue against it vigorously if they perceive that a competitor is not being fair. In addition, SRAs are also alert to signs of potential bias in SRG members.)

If the problem lies with the SRG, revise the application and request review by a different SRG. See directions under Cover Letter on page 17. Give reasons for the request (lack of reviewer expertise, lack of interest in the subject, differing philosophies (e.g., a molecularly oriented review group reviewing a clinical application). Try to suggest an alternative SRG.

For fatal flaws and weaknesses, rethink your idea and start over.

Revising Your Application

Read and reread the summary statement. Identify the problems. Before you start revising, talk with your program administrator (go to NIAID's program and staff list at at **http://www.niaid.nih.gov/ncn/staff/p-and-s.htm**) to review your summary statement and get advice. Also, ask someone in your institution who is experienced in grantsmanship and not involved in your proposed research to review your application, summary statement, and revision plans.

Respond to reviewers' comments

The key to successfully revising your application is to respond to the comments and suggestions of the reviewers. Address reviewers' comments point by point—you need not agree with all points, but you must address them. If you disagree with the reviewers, explain why and provide additional information if needed. Include any new preliminary data you may have.

Use page numbers and other identifiers so reviewers can easily find where you have added new data or revised experimental approaches. A bar in the margin is a good way to show where revisions are; highlight new sections with indenting, bracketing, underlining, or change of type.

Revised applications must include an introduction limited to one page and not counted in the 25-page limit. Help reviewers understand your revisions by following the instructions in the PHS 398 application kit. Your summary should state substantial additions, deletions and changes in the revised application and address the main criticisms in the summary statement.

Even if you respond adequately to the criticisms in the summary statement, you are not guaranteed an award. This may happen because a summary statement is not meant to be an exhaustive critique; some problems discussed by the reviewers may not appear in it. Also, when you make changes, you risk introducing new problems. Finally, membership in scientific review groups changes. Your application may be seen by some new reviewers who may have different views of your project.

If you still don't get funded after the second try, try again! Data show that persistence pays off. NIH allows you to revise and resubmit the application for review two more times.

XII. When Your Application Is Approved for Funding

If an institute or center (IC) approves your application for funding, NIH staff will contact you or your institution to discuss when the award is to start and the funding level of project. You may also be asked to submit additional information, e.g., updated information on budget costs and other support or information, and certification on institutional approval of human and animal research (see Modular and Just in Time, page 14). It is important to send theses items to us as soon as possible since issuing the award may be contingent on our receipt of this information from you.

Upon satisfactory completion of all requirements, the IC sends your institution a Notice of Grant Award, which states the amount of funding for current and future years start and end dates, and the terms and conditions of the award.

If it is your institutions's first NIH award, you will also receive a "Welcome Wagon" letter with lots of important information on what to do. Read it carefully.

There are many rules and procedures pertaining to grants. In addition to the sources listed below, you can read more about rules and regulations in the PHS Grants Policy Statement on the Internet at **http://www.nih.gov/grants/policy/nihgps/**.

For updates on changes in policies and procedures, read the notices published weekly in the *NIH Guide for Grants and Contracts,* available on the Internet at **http://www.nih.gov/grants/policy/ notices.htm**.

Documentation

Two items of special importance to NIH are the animal welfare and protection of human subjects assurances. Most universities that have received grants or contracts from NIH have Multiple Project Assurances on file with the Office of Protection from Research Risks (OPRR). If your institution does not have a Multiple Project Assurance, the awarding office will contact OPRR, and your institution must negotiate a Single Project Assurance before the award is made.

Human subjects

For information concerning the human subjects assurance, contact OPRR at:

> Division of Human Subject Protection
> Assurance Staff
> Office for Protection from Research Risks, OER, NIH
> 6100 Executive Boulevard MSC 7507
> Suite 3B01
> Rockville, MD 20892-7507
> 301/496-7005

To assist researchers, institutional administrators, and institutional review board (IRB) members, OPRR produced a 1993 publication, Protecting Human Research Subjects: Institutional Review Board Guidebook. It is available for $31 from the U.S. Government Printing Office (202) 512-1800; stock no. 017-040-00525-3. OPRR also provides an instructional videotape on the protection of human subjects.

This free videotape contains three programs:

1. Evolving Concern, Protection for Human Subjects
2. Balancing Society's Mandates, IRB Review Criteria
3. The Belmont Report, Basic Ethical Principles and their Application

For a copy of the videotape, contact:

Education Program Coordinator
Division of Human Subject Protection
Office for Protection from Research Risks, OER, NIH
6100 Executive Boulevard MSC 7507
Suite 3B01
Rockville, MD 20892-7507
301/496-7005

Animals in Research

For information on animal welfare assurance requirements or to request the publication Public Health Service Policy on Humane Care and Use of Laboratory Animals, contact:

Division of Animal Welfare Assurance Staff
Office for Protection from Research Risks, OER, NIH
6100 Executive Boulevard MSC 7507
Suite 3B01
Bethesda, MD 20892-7507
301/496-7163

What You Can and Cannot Pay for on a Grant

In most cases, your grant support will pay for direct (project-specific) costs plus the indirect costs negotiated for your institution. Information on direct and indirect costs that may be charged to a grant are outlined in five sets of cost principles:

OMB Circular A-21	Institutions of Higher Learning
OMB Circular A-87	State and Local Governments
OMB Circular A-122	Nonprofit Organizations
45 CFR Part 74, App. E.	Hospitals
FAR 48 Subpart 31.2	For-Profit Organizations

For more information, see also the PHS Grants Policy Statement (see address above). Check to see what expenditures are allowed. With the advent of modular grants, NIH no longer requires you to request approval to rebudget funds.

Terms and Conditions of Award

Acceptance of the grant means you agree to be bound by its "terms and conditions." (To learn more about these, see the PHS Grants Policy Statement.) As is stated in your Notice of Grant award, your grant is subject to terms and conditions in:

Grant program legislation

Grant program regulations

Notice of Grant Award (including terms and conditions)

PHS Grants Policy Statement

45 CFR Part 74 or 45 CFR Part 92

NIH provides the terms and conditions as an attachment to the Notice of Grant Award. It is important that you review the entire document when setting up project expenditures or your scientific plan.

Reporting Requirements

Financial Status Report. When required, Financial Status Reports are due 90 days after the close of a budget period, on Standard Form (SF) 269 or 269A. For NIH awards, send the Financial Status Report to the NIH Division of Financial Management for review and acceptance, which forwards them to the awarding institute.

Address and phone number are:

NIH
DFM/FAAB/Grants Section
Building 31, B1B11
Bethesda, MD 20892-2052
301/496-5287

For grants under the Streamlined Noncompeting Application Process (SNAP), a Financial Status Report is required only at the end of a competitive segment rather than annually. For more information on these modified reporting requirements, go to **http://www.nih.gov/grants/policy/ snap3.htm** or contact your grants management specialist listed on your notice of grant award.

Progress Report. NIH grants require a minimum of an annual report, due to the Institute as part of the noncompeting application (PHS Form 2590) 60 days before the start of each budget period. Final Progress reports are due 90 days after the expiration or termination of the grant.

Invention Report. NIH grants must comply with government-wide patent regulations as stated in Title 37 CFR part 401. Inventions must be reported in any noncompeting or competing continuation application and included on the Final Invention Statement and Certification required within 90 days after the expiration or termination of support.

NIH now enables you to fulfill your invention reporting requirements online using a system called Edison. Internet address is: **http://era.info.nih.gov/Edison/**.

Checklists

BEGINNING CHECKLIST

Do I know the field and its literature well?

Do I know the important research questions in my field?

Is the field overpopulated with researchers?

Did I check the literature to make sure the project I'm considering has not been done before or has been done and its methods judged to be inadequate?

Did I discuss my proposal with program staff in the appropriate institute?

HYPOTHESIS CHECKLIST

Is my proposal driven by a strong hypothesis?

What specifically am I setting out to prove?

Is the central research question important to the field?

Is the hypothesis testable by current methods?

Did I state my hypothesis in the abstract and specific aims section?

RESEARCH PLAN - PLANNING CHECKLIST

Answer these questions when you *develop* your research plan.

Is my plan hypothesis driven?

Does my project have a coherent direction?

Are the aims of the project I am considering achievable?

Does my project relate to a central focus?

Have I tried to do too much?

RESEARCH PLAN - PROCESS CHECKLIST

Answer these questions when you *write* your plan.

Am I presenting the information logically and clearly?

Am I highlighting the importance and innovation of my project?

Am I following the exact format in the specified instructions?

Am I explaining what gaps in science my project would fill?

Am I referring to the literature thoroughly and thoughtfully?

Did I state my hypothesis in the specific aims and in the abstract and provide a logical rationale for the hypothesis?

Did I prepare an appropriate budget, having checked the notices in the NIH *Guide* for any new requirements?

Did I provide all necessary information for human subjects and animals?

Did I include a timetable for the proposed research?

SPECIFIC AIMS CHECKLIST

Do my specific aims and objectives support and test my hypothesis?

Are they tightly focused?

Did I present alternatives to my hypothesis and the reasons I chose the one I did?

Can my objectives be assessed by the review committee?

BACKGROUND AND SIGNIFICANCE CHECKLIST

Did I show how my research is innovative?

Did I state how it will increase knowledge in the field?

Did I include background information about the field?

Does the literature section show reviewers my understanding of the field?

Did I show that I know the gaps or discrepancies in the field?

Did I identify the next logical research beyond this application?

PRELIMINARY DATA CHECKLIST

Do the preliminary data support the hypothesis to be tested?

Do they show the feasibility of the project?

Did I explain how the results from my preliminary studies are valid and how they will be expanded?

Did I interpret my results critically and provide alternative meanings to them?

DESIGN AND METHODS CHECKLIST
General

Does each experiment correspond to one of the specific aims, and is it stated in the same order?

Do the experiments follow a logical sequence?

Did I estimate what I expect to accomplish each year and state foreseeable delays?

Did I describe any hazardous procedures, situations, or materials and appropriate precautions?

Did I include supporting data?

Does my appendix include publications showing my use of the methods I have described?

Approach

Are the methods I chose appropriate to achieve the specific aims?

Did I show why each experiment is important or how it is relevant to the hypothesis?

Will reviewers think I am knowledgeable about my methods?

Did I justify my choice of methods, in detail if they are innovative?

Did I support my methods with data?

Did I outline my methods in detail?

Did I point out and provide solutions for potential problems?

Is my proposed model system appropriate?

Did I address difficulties I may encounter with the proposed approaches, show I can handle them, and propose solutions and alternatives?

Did I consider how the limitations of the approaches may affect my results and data?

Did I address possible problems and limitations of the procedures, and propose solutions?

Did I use enough detail?

Did I include all relevant controls?

Results

Did I show I am aware of the limits to and value of the kinds of results I expect?

Have I convinced reviewers I will be able to interpret my results?

Have I enlisted help from a statistician if needed and discussed statistical methods to be used?

Did I define the criteria for evaluating the success or failure of a specific test.

ABSTRACT CHECKLIST

Did I stay within the 200-word size limitation?

Did I state my hypothesis?

Does my abstract describe my objectives?

Does the abstract state the importance of the research and how it is innovative?

Does it outline the methods I will use to accomplish my goals?

BIOSKETCHES CHECKLIST

Does each biosketch include all required details (name, title, education, and employment history)?

Are roles in other relevant research included?

Did I describe the aims of current and recent past support?

Have I included the biosketches in the proper order (principal investigator, then all others in alphabetical order by last name)?

Have I kept to the 3-page limitation for modular grants or 2 pages for nonmodular?

BUDGET CHECKLIST

Is my budget realistic and appropriate for the aims and methods of the project?

Could any of my requests appear to be extravagant or include resources already available to me?

Does the PI's salary exceed the government cap of $125,900?

RESOURCES CHECKLIST

Does my description of my resources show adequate equipment, space, and support staff to conduct the research?

WRITING CHECKLIST

Have I carefully read the instructions and followed the rules, such as those for page limitations and type (font) size?

Did I follow the format outlined in PHS 398?

Is the writing as clear and concise as it can be?

Have I edited and proofread the application thoroughly?

Does the application have a pleasing presentation, e.g., no crowding of information and well organized?

Is the type clean and legible?

Did I have several colleagues critique the application?

REVISING CHECKLIST

Did I read the summary statement and identify the problems.

Did I address reviewers' comments point by point identifying changes clearly

Did summarize substantial additions, deletions and changes in one page?

Did I clearly distinguish sections that are the same in the previous application and those that are different, showing precisely where I added new information?

If I disagreed with the reviewers, did I explain why and provide additional information?

Did I follow the instructions in PHS 398?