

How to Write a Research Grant

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FOCUS YOUR APPLICATION

Before You Start Writing

Before starting to write the application, do some planning. It generally takes three to six months to write a grant application, and another nine months or so from the time it is sent in until it gets funded. Check with the University's Office of Sponsored Projects to see what deadlines they have – you will need to get their signature before you send the application to NIH. Allow time for your own internal review and to make edits. Next, find out what documentation you will need to prepare - any special requirements; e.g., animal or human subjects. One way to make sure your planning and feedback are adequate is to put together your own review committee before you write the application. Ask a few senior colleagues to be on it, and share your ideas with them while you are still in the concept stage. After you have agreed on a project, draft a short description of your specific aims and discuss these with the committee. This will give you early input and help to make sure you are writing and organizing effectively. Also, be sure to have your committee read it when you have finished.

Do not Propose Too Much

Sharpen the focus of the application. Novice applicants often overshoot their mark, proposing too much. Make sure the scale of aims fits the request of time and resources. Reviewers will quickly pick up on how well matched these elements are. The hypothesis should be provable and the aims doable with the resources you are requesting.

Address NIH Review Criteria

NIH review criteria:

- Significance: ability of the project to improve health
- Approach: feasibility of the methods and appropriateness of the budget
- Innovation: originality of the approach
- Investigator: training and experience of investigators
- Environment: suitability of facilities and adequacy of support from your institution

Though applicants will want to address NIH's review criteria in the application, their relationship to the score is complex. Reviewers are told to keep the five criteria in mind, yet the final priority score they assign is more likely to reflect a judgment of overall merit. In practice, reviewers use their experience to get a sense of how the application stacks up against the science in the field, using a hypothetical standard of excellence for the particular field of science. This is similar to a dog show, where breeds are judged for "best of breed," and different breeds do not compete with each other.

Therefore, there is not a one-to-one relationship between how the application measures up to the review criteria and the score. Furthermore, adherence to the criteria varies by review committee. The take-home message is: though review criteria are an important assessment tool that

applicants need to take into account, writing a high-quality application with a persuasive argument for why NIH should fund the proposal is the surefire route to getting funded.

An application does not need to be strong in all review criteria to warrant a high priority score, though all the criteria can affect the score. For example, reviewers may assign an outstanding score to a proposal for important work that is not innovative but is essential to move a field forward.

Though innovation is one of the review criteria, it can be harder to gain reviewer acceptance if the ideas are outside the mainstream of thought, especially if the applicant is relatively inexperienced.

Write to the Audience

The application has two audiences: the majority of reviewers who will probably not be familiar with the particular techniques or field, and a smaller number who are. To succeed in peer review, win over the primary reviewer who should be familiar with the research field and who will act as an advocate in guiding the group's decisions. Peer reviews work this way because time is limited and discussions are short.

The objective is to write and organize the application so the primary reviewer can readily grasp and explain what is being proposed. During the discussion, the other reviewers will ask the primary reviewer questions about the application, and they will also skim it during that time (and possibly before the meeting as well). Most likely, the other reviewers will read only the abstract, significance, and specific aims. But all reviewers are important because each reviewer gets one vote.

Be Persuasive, but Be Careful of Being too Innovative

Capture the reviewers' attention by making an argument for why the proposal should be funded. Tell the reviewers why testing the hypothesis is worth funding, why you are the person, and how your institution can give you the support you will need to get it done. Another approach is to write the application as if you were teaching the audience about your application. Like a *Scientific American* article, include enough background information to enable an intelligent reader to understand your proposed work.

The innovation criterion can be tricky to factor into the proposal. Beware of being far outside the mainstream of thought. If your proposal is highly innovative, you will need to make a very strong case for why you are challenging the existing paradigm and have the data to support your innovative approach.

Balance the Technical and Nontechnical

Applicants will need to balance technical and nontechnical writing, especially in the specific aims. This is because most reviewers simply scan the application, and they may not be familiar with the research field or methods.

One way to organize the technical and nontechnical information is to keep the parts of the application most reviewers will likely read -- abstract, significance, and specific aims -- simple

and nontechnical, and put technical and detailed information only in the methods section. The methods section will need to spell-out all the experiments in fine detail. Another approach is to include both technical and nontechnical information throughout the application. For example, applicants can alternate paragraphs that have less and more technical information. To be safe, be sure to include both broader, less technical descriptions as well as more technical information in the most widely read sections of the application.

However, be very careful with highly technical material. Some of the reviewers are better informed about the field than the applicants. To succeed, applicants will have to be at least as savvy as the savviest reviewer in the group. Leave out anything that is not critical. The more you put in, the more information there is for reviewers to find fault or disagree with.

Make Life Easy for Reviewers

Peer review puts a burden on reviewers, so they truly appreciate an application that is neat, well organized, and easy to read. To keep reviewers on your side, make your application user friendly. Here's how:

- **Label all materials clearly.** Make it easy for reviewers to find information.
- **Keep it short and simple.** Start with basic ideas and move progressively to more complex ones. State the key points directly, and write basic concepts as nontechnically as possible. Applicants may want to use *Scientific American* as a model for the level of writing to use for the nontechnical parts.
- **Guide reviewers with graphics.** A picture is worth a thousand words, probably more. Graphics can help reviewers grasp a lot of information quickly and easily, and they break up the monotony of the hundreds of pages of text each reviewer contends with.
- **Edit and proof.** The presentation can also make or break the application. Though reviewers assess science, they are also influenced by the writing and appearance of the application. If there are a significant number of typos and internal inconsistencies in the document, the score can suffer.

Know These Review Problems and Solutions

Avoid the main traps applicants fall into. Reviewers are knowledgeable, experienced scientists, but they can't know everything.

Problem: They may not get the significance of the proposed research.

Solution: Write a compelling argument.

Problem: They may not be familiar with all the research methods.

Solution: Write to the non-expert in the field.

Problem: They may not be familiar with the research lab.

Solution: Show them you can do the job.

Problem: They may get worn out by having to read 10 to 15 applications in detail.

Solution: Write clearly and concisely, and make sure the application is neat, well organized, and visually appealing.

More Common Problems Cited by Peer Reviewers

Below is a list of the most common reasons cited by reviewers for an application's failure to gain an award:

- Problem not important enough.
- Study not likely to produce useful information.
- Study is based on a shaky hypothesis or data.
- Alternative hypotheses not considered.
- Methods unsuited to the objective.
- Problem more complex than investigator appears to realize.
- Not significant to health-related research.
- Too little detail in the research plan to convince reviewers the investigator knows what he or she is doing. No recognition of potential problems and pitfalls.
- Issue is scientifically premature.
- Over-ambitious research plan with an unrealistically large amount of work.
- 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 original or new ideas.
- Investigator too inexperienced with the proposed techniques.
- Proposed project a fishing expedition lacking solid scientific basis. No basic scientific question being addressed.
- Proposal driven by technology (a method in search of a problem).
- Rationale for experiments not provided (why important, or how relevant to the hypothesis).
- Experiments too dependent on success of an initial proposed experiment. Lack of alternative methods in case the primary approach does not work.
- Proposed model system not appropriate to address the proposed questions. Relevant controls not included.
- Proposal lacking enough preliminary data, or preliminary data do not support project's feasibility. Insufficient consideration of statistical needs.
- Not clear which data were obtained by the investigator and which reported by others.

Organizing, Writing, and Formatting

Master the PHS 398 Application

Make sure to follow all instructions on the PHS 398 application, but beware; NIH strictly enforces formatting requirements and may return improperly formatted applications! Do not risk having the application returned because of exceeded page limits or improper use of font, font size, or margins.

Know the page limits -- 25 pages for an RO1 application. See page 4 of the 398 for other limits. Only sections A-D of the research plan count toward the page limit. Thus, the biosketches and information about human subjects, animals, literature, consortium arrangements, and consultants do not.

Not only are font size and spacing requirements strictly enforced, but applicants should avoid alienating reviewers with hard-to-read type. The minimum specifications are:

- 10-point font size is the minimum allowed; however, reviewers generally prefer 11 or 12-point font. NIH suggests using Helvetica or Arial 12 point.
- The font cannot average more than 15 characters per inch (CPI), though fewer may be better.
- Use no more than 6 lines per vertical inch -- do not squeeze lines together.
- Margins must be at least 1/2 inch.
- Font size in figures and tables may be smaller but must be easily readable.

There are other specifications as well. For example, the document must not be permanently bound, and, except for the appendix, it must be photocopy-ready (black and white, no glossy paper). Read the 398 for further details.

The 398 includes a list of definitions used in the document (http://grants.nih.gov/grants/funding/phs398/section_3.html). Also note that it is a living document that is continually being revised. If you need help writing or formatting your application, call SPA in either Center for Scientific Review (CSR) (<http://www.csr.nih.gov/>) or National Institute of Allergy and Infectious Diseases (NIAID).

Plan and Organize Effectively

Organize the application to effortlessly guide reviewers through it. For example, reviewers expect the research plan to be organized exactly as described in the 398 instructions, so label sections accordingly: A. Specific Aims, B. Background and Significance, etc.

Within that structure, pick one of several methods of organization for different sections of the application, or combine them effectively. You can organize by:

- Order of your experiments in the methods section.
- NIH review criteria.
- More and less technical material.

Applicants can also make it easy for the reviewers to find material by using strong paragraph headers and an abundance of graphics and tables. Such items help organize and illustrate the ideas. Graphical timetables for experiments can effectively illustrate their flow and timeframes. Include any overlap, and show plans in case of a negative result. The graphics can illustrate timetables and flow charts of planned experiments, showing alternatives depending on experimental results as well as the staff and resources needed at each stage.

Write, Edit, and Proof Like a Pro

Make it easy for the reviewers - they will appreciate it! All the basic concepts learned in English (or other language) writing classes apply to writing an NIH grant. These basic techniques will help keep the writing streamlined and well organized so reviewers can readily glean the information. Here are a few tips:

- **Start with an outline.** Each section should logically and smoothly flow from the previous section.
- **Write a topic sentence for each main topic.** Then write a topic sentence for each sub topic in the outline.
- **Make one point in each paragraph.** This is key to creating text that is easy to read. State the point in the topic sentence, usually the first sentence, and support it with additional information in the subsequent sentences. Paragraphs have two functions: they aggregate information point by point and they break up the page creating much-needed white space. Keep them short.
- **Divide the document into sections and subsections.** This organizes the text and helps to create white space. Reviewers are human; if your application looks too hard to read, they are much less likely to read it. For further instruction on text organization, go to http://www.niaid.nih.gov/ncn/grants/write/runon_text.htm.
- **Include bullets and lists.** They draw attention to key facts and create a visual break.
- **Use short sentences with a basic structure: subject, verb, object.** Breakup long, involved sentences and paragraphs. Keep sentence average to 20 words or less. Keep subject, verb, and object together at the beginning of the sentence.
- **Include transitions.** At the end of the paragraph or concept, make a transition to the next point. Use words such as: furthermore, additionally, in other words, in another area, in contrast, following the same path, moving to the next stage.
- **Keep related ideas and information together.** Put clauses and phrases as close as possible to, and preferably right after, the words they modify.
- **Use strong, active verbs** -- they are the workhorses of effective sentences. For example, write, "We will develop a cell line," not a "A cell line will be developed."
- **Use verbs instead of abstract nouns.** Turn abstract nouns ending in "ion" and "ment" into verbs. For example, say "creating the assay leads to..." rather than "the creation of the assay leads to..."
- **If writing is not your forte, get help.**

Edit Before Sending in the Application

Editing is the key to good writing. A strong editor can makeup for fairly poor writing, so make sure to spend quite a bit of time on the edit. Also, it is always a good idea to have someone else edit the proposal before it is submitted.

- **Edit out redundant words and phrases.** Make sure the writing is concise and informative. Get outside opinions on the writing and presentation. Sloppy work will suffer in review -- reviewers feel that if the application is sloppy or disorganized, the research may be as well.
- **Cross check all data and information for consistency.** Also, after the proposal has been written, leave it for a few days, then go back and read it again. Most editors find more errors, particularly with complex data.
- **Highlight and review the conclusions.** Is there any way the supporting facts might lead the reader to different conclusions? If so, revise the work so there is no room for argument (or reconsider the conclusions).
- **Make sure to support all facts with citations.**

- **Edit and proofread thoroughly.** Make sure your work is letter perfect. If you cannot meet the application deadline comfortably, consider delaying to the next receipt date.
- **Proofread several times on different occasions,** and have others proofread as well, including nonscientists with strong English skills. After the content is final, check for typos and grammatical mistakes, omitted information, and errors in figures and tables.

Two More Small Points for Preparing the Applications

1. NIH discourages using URLs for source material in the application. Reviewers are not obligated to use the Web for their review. Some people feel viewers may be traceable, for example, if you include links to your site compromising the anonymity of the primary and secondary reviewers. However, not every reviewer feels this way and not all sites are insecure, so use your judgment.
2. Include only information that will photocopy well since your application will be photocopied before it is sent to reviewers. If the application uses colored or glossy materials, put them in the appendix -- reviewers get originals of those. All graphs and charts not on glossy paper go in the research plan, not the appendix. Do not paste photographs into the application.

THE NIH GRANT APPLICATION: SECTION BY SECTION

Introduction

Instructions in the official grant application, PHS 398

(<http://grants.nih.gov/grants/funding/phs398/phs398.html>), house a lot of information that is needed to complete the application. Some instructions are general, and some are specific to a section. This guide does not reproduce that information.

On the 398 Web site, the Table of Contents (<http://grants.nih.gov/grants/funding/phs398/phs398.html>) links directly to the application instructions and forms. NIH gives the 398 forms in two formats, PDF and RTF. Applicants are advised to use the PDF forms to avoid formatting problems with RTF that occur with some word processors. The PDF forms are linked to the 398 instructions; click on the plus sign to access the instructions for each form. If you have a slow connection, you may want to download individual forms (<http://grants.nih.gov/grants/funding/phs398/phs398.html>); if your connection is fast, you can download all the forms (ftp://ftp.grants.nih.gov/forms/398_forms.pdf).

Develop the Research Plan

Creating a top-quality research plan is critical to your application's success in peer review. The research plan describes what you are proposing to do, why it is important, and how you will do it. Following the 398, the research plan will have four main sections: A. Specific Aims, B. Background and Significance, C. Preliminary Studies/Progress Report, and D. Research Design and Methods.

You should design your research to answer the question posed by your hypothesis. Throughout, give enough detail to convince the primary and secondary reviewers that:

- Your hypothesis is sound and important.
- Your aims are logical and feasible.
- You understand potential problems.
- You can analyze the data.

There is no required form or format for the research plan - use the continuation page of the 398 or plain paper with appropriate margins and headers. The 25-page application limit applies only for items A-D. Number all pages. Read the PHS 398 grant application kit carefully to make sure you are including all needed sections and are complying with formatting requirements.

How to Organize the Research Plan

Think about how to organize the research plan. Give reviewers guideposts by organizing effectively. For the bigger picture organization, keep to the sections a-d format in the 398 instructions. Then, depending on what works best for you, fine tune the next level by organizing the material either by review criteria, the order of the experiments, more and less technical material, or a mixture of these approaches. Make sure to coordinate the sections so they progress logically.

No matter how you organize, list all experiments you plan to do for each specific aim, showing start and stop points for each one. Also, tell reviewers what staff you will need to accomplish your aims. Be sure to correlate the time you indicate it will take to complete the experiments with the budget and personnel you are requesting.

For maximum effectiveness, include graphical timetables to illustrate the flow and timeframes of the experiments. In decision trees, show any overlap among them and plans in the event of a negative result.

To save time and space, use well-known references for the more technical material. If a citation is known in your field, reviewers will be familiar with it. Therefore, simply refer to the citation and leave out details related to it.

Do not put anything in the research you do not plan to do! Keep it streamlined. The more you put in, the greater the chances of making a mistake.

Research Plan Section A. Specific Aims

The specific aims are the objectives of the research project, what you want to accomplish, and the project milestones. Write this section for a wide audience. Primary and other reviewers will all read it. Choose aims reviewers can easily assess. The aims are the accomplishments by which the success of the project is measured. Recommended length of this section is one page.

A common mistake new applicants make is being too ambitious. Try to limit the proposal to three to four specific aims.

Design the specific aims and experiments so they answer the question posed by the hypothesis. Organize and define the aims so they can be directly related to the research methods.

Begin this section by stating the general purpose or objectives of the research. You may want to organize it in outline form: specific aim 1, specific aim 2, etc.

If applying for more than one grant, make sure the specific aims differ.

Research Plan Section B. Background and Significance

Remember that this is one of the three sections likely to be read by all the reviewers, so write this section in non-technical terms for the broader audience. It is important to convey the significance of the research and how it relates to the betterment of public health. Recommended length of this section is two to three pages.

In the Background and Significance section, show that you are aware of opportunities, gaps, and roadblocks in your field. Show reviewers your intimate familiarity with the field and knowledge about research being done, referring to all relevant scientific literature. If you leave out an important work, reviewers will assume you are not aware of it.

Use this section to convey the breadth of your knowledge of your field and highlight why you are uniquely qualified to do the research. While applicants can refer to unpublished work, including information learned through personal contacts, make sure the literature noted here is also in the Literature Cited section (http://www.niaid.nih.gov/ncn/grants/write/write_p1.htm).

Tell the reviewers how your work suits the NIH mission to improve health through science -- just moving science forward is not enough. Tie your science to curing, treating, or preventing disease. When reviewing your application, reviewers will judge the likelihood that your research can make an impact on public health.

Research Plan Section C. Preliminary Studies/Progress Report

By providing preliminary data, applicants build reviewer confidence that they can handle the technologies, understand the methods, and interpret results. Preliminary data will help show that you have the expertise to do the job. Recommended length of this section is six to eight pages.

Interpret preliminary results critically. Give alternative meanings to the data to show that you have thought the problem through and will be able to meet future challenges. If you do not do this, the reviewers will.

Include enough information to show that you know what you are talking about. The more complex the project, the more data needed. Tell reviewers how your early work prepares you for the new project.

Though you may include publications of others, focus on your own preliminary data or unpublished data from your laboratory. When using results from other labs, make sure it is clear which data are yours and which emanated from others.

Research Plan Section D. Research Design and Methods

When reviewers judge applications, the Research Design and Methods section has the most weight. This section describes the experimental design and procedures -- how the research will be performed. Think carefully about how to organize it. Applicants may want to divide the Research Design and Methods section into a description of the research, followed by the methods. Another option is to organize this section by the five NIH review criteria. There is no recommended page length to this section, though applicants must stay within the 25-page limit of the research plan sections A to D.

It is helpful to create a graphical timetable displaying how and when the aims will be accomplished, including any overlap of experiments and alternative paths. Use flow charts and decision trees to show paths of experiments and how they progress, including paths that show alternatives -- what will be done in case of negative results. Applicants can use the same graphics they created to plan the project in the application.

Research Plan Section D: General

Make sure reviewers can find items easily, so organize this section to correspond to the specific aims. This part should give details -- specify animal models, exposure times, reagents and how they will be acquired, statistical analysis methods, etc.

While many assume that reviewers are experts in the field and familiar with current methodology, they will not make the same assumption about you. Therefore, 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 a system; and exactly how the techniques will be used. Details show applicants understand and can handle the research.

Cite references wherever possible. If a technique is well known, the citation is enough. One caveat: Though detail is important, do not give more information than is needed to state the case. Reviewers will look for flaws and penalize applicants heavily for them. Do not give them ammunition by including anything in the application you do not plan to do.

Remember that if the proposal is highly innovative, applicants need to make very strong cases for challenging the existing paradigm and have data to support innovative approaches.

Note: If additional data is gathered between the time of application submission and the date of the review, applicants may be able to send the new data to the SRA of the study section reviewing the application. Call the SRA to find out whether this is possible and the deadline. Policies vary among study sections.

Research Plan Section D: Approach

After giving an overview of the type of proposed research, defend the choice of study design. Be sure to state the expected outcome of the research.

Next, list each set of experiments in the same order as the specific aims (http://www.niaid.nih.gov/ncn/grants/write/write_j1.htm), linking the experiments to the aims so reviewers can see how they will be achieved. Anticipate reviewers' questions about the feasibility of the proposal; e.g., how you will gain access to reagents, equipment, or study populations. Describe sources if reagents or equipment are not generally available. If collaborators will provide them, include letters from the sources in the appendix.

Make sure the experiments are in a logical sequence, flowing from one another with clear starting and finishing points. Show a timeline for experiments and be sure to propose a realistic level of work for the allotted time. Estimate how much will be accomplished each year of the grant and state any anticipated potential delays.

Applicants should also ask themselves if the procedures are feasible and within their competence – are the methods the best for this research? If the methods are innovative, state why you chose them and how you will avoid technical problems. If you are working with hazardous materials, your application must state what special facilities are available to protect the environment and staff. Describe the precautions you will take in handling the materials and the training the people involved have had in safe practices.

In this section, discuss any limitations of each approach and how they may affect the results and data. Call attention to potential difficulties that may be encountered and propose alternatives. List plans in the event of negative results, describe how this research will advance the field, and note future research plans. Discuss in detail the methods for gathering and interpreting data and making sure that the experiment can yield statistically significant results.

If you or your collaborators have publications showing your use of the proposed methods, put them in the appendix (http://www.niaid.nih.gov/ncn/grants/write/write_s11.htm). The appendix may include only published manuscripts or those accepted for publication. Write it in more detail if you have little published experience in a method.

To fill-in expertise, rely on consultants. State how collaborators or consultants will fit into the work. List them as key personnel, and provide biosketches (http://www.niaid.nih.gov/ncn/grants/write/write_s7.htm).

Reviewers expect to see supporting data. Where appropriate, include well-designed tables and figures that have accurate and informative titles. Label the axes and include legends. Reviewers will look for discrepancies between the data and text. Check and double check to avoid glitches.

Make sure to reference all the methods and concepts that are listed in the Literature Cited, section g. (http://www.niaid.nih.gov/ncn/grants/write/write_p1.htm) of the research plan.

Research Plan Section D: How to Deal With Results

To succeed, an application must convince reviewers that the applicant will be able to interpret the results. Do this by revealing your understanding of the complexities of the subject and your breadth of knowledge of the field.

Show 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 experimental data would support or contradict the hypothesis and the limits you will observe in interpreting results. You should also define the criteria for evaluating the success or failure of a test.

Consider getting a statistician involved early on to advise on sample sizes and the amount of data needed to collect. Describe the statistical methods for analyzing the collected data. Well-designed statistical methods will favorably impress reviewers.

Research Plan Section D: Address Requirements for DNA Research

If using recombinant DNA, the rules are complex -- different types of work call for different application procedures. To figure out what to do, a good place to start is by contacting the biosafety officer and institutional biosafety committee. Most institutions require approval of proposals by this committee. Depending on the nature of the project, NIH may require this approval as well as the Recombinant DNA Advisory Committee, the NIH director, or other approvals.

For details on approval processes, see section III on page 11 of the guidelines of the NIH Office of Biotechnology Activities. Also see the 398 Section III, Other Information N. RDNA and Human Gene Transfer Research (http://grants1.nih.gov/grants/funding/phs398/section_3.html). You can also call the NIH Office of Biotechnology Activities for help at 301.496.9838 and find more contact information on the Web, including a news listserve for subscribers at <http://www4.od.nih.gov/oba/IBC/IBCindexpg.htm>.

Section E. Human Subjects

Is it Human Subjects Research?

If you are studying materials from identifiable people, the work probably qualifies as human subjects research, even if you are not seeing patients. NIH defines human subjects research as research involving living persons with whom an investigator directly interacts, intervenes, or obtains identifiable, private information. See the decision trees reviewers use to determine whether your research involves human subjects and what is required if it does at <http://www.niaid.nih.gov/ncn/tools/decisiontrees/hsgloss.htm>.

If you must conduct human subject research, get help in applying from your business office and experienced grantees. If you are not conducting human subject research, indicate "Not applicable" in this section of the research plan.

If you are not studying human subjects but your collaborators are, you will still need to make sure the assurances are in place.

If the Answer is Yes for Human Subjects

If your project studies human subjects or samples, read the human subjects section of the 398 carefully. Be sure to follow all instructions to the letter. You will also need to fulfill Institute-specific requirements -- see the NIAID Clinical Terms of Award at <http://www.niaid.nih.gov/ncn/pdf/clinterm.pdf>.

In the latest update, the PHS 398 expands reporting and inclusion requirements. The key features are:

- Description of how subjects will be protected from research risks
- Plans to include
 - Women
 - Children - include expertise to study children, suitability of the facilities, and how researchers will recruit enough children
 - Minorities
 - Analyses capable of showing intervention differences between men and women and between minorities and non-minorities for phase III trials
- Data and safety monitoring plans
- Mandated reports
- Benefits to public health

If you fail to include required documentation, you can face dire consequences -- NIH has the option of not reviewing your application

(<http://ohrp.osophs.dhhs.gov/humansubjects/assurance/filasuri.htm>). To reduce risk, leave reviewers no questions about what you propose to do. Clearly show how you will include diverse populations and protect subjects from study-associated risks. Also state the benefits of the study to the patients and to public health.

Reviewers Look at More Data for Human Subjects

In addition to the regular review criteria, clinical research applications are also reviewed for:

- Adequacy of plans to include both genders, minorities and their subgroups, and children as appropriate to the research goals. Reviewers will also assess plans to recruit and retain subjects.
- Reasonableness of the proposed budget and duration in relation to the proposed research.
- Adequacy of the proposed protection for humans, animals or the environment, to the extent they may be adversely affected by the research.
- Adequacy of the proposed plan to share data, if appropriate.

Inadequately addressing these issues will negatively affect the applicant's priority score, while failure to address them may result in the application not being reviewed.

Research Plan Section F. Vertebrate Animals

As with human subjects, applicants must also provide assurances that research animals are treated properly, and state the benefits of the research to humanity. When preparing the

application, read the Vertebrate Animals section of the PHS 398 (http://grants1.nih.gov/grants/funding/phs398/section_1.html), which lists five elements the application must describe. If not conducting vertebrate animal research, indicate "Not applicable" in this section of the research plan.

Reviewers will also assess the adequacy of proposed protection of animals, to the extent they may be adversely affected by the research.

In the application, do not forget to include Institutional Animal Care and Use Committee approval of the project (<http://grants.nih.gov/grants/olaw/olaw.htm>). Either send it with the application or, if the approval is delayed, within 60 days of that date to your SRA.

Research Plan Section G. Literature Cited

In this section, refer to the literature thoroughly and thoughtfully but not to excess, listing all publications supporting the hypothesis and methods. The publication list need not be exhaustive, probably less than 100 of the most relevant citations. There is no page limit to this section.

Each citation must have 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.

Citations show reviewers your breadth of knowledge of your field. Research proposals 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 that the methods were found to be inappropriate for the research questions.

Research Plan Section H. Consortium and Contractual Agreements

If working closely with an investigator from another institute, be sure to include a consortium agreement -- an agreement of collaboration between two institutions. Briefly describe any consortium or contractual arrangements, stating the roles of the people or organizations involved. The business offices of both organizations will transact a formal agreement in a letter describing research roles and their understanding of the arrangement. Put the letter in the appendix. Make sure the information in this section matches that on the modular budget justification page, and be sure to include all key personnel (http://www.niaid.nih.gov/ncn/grants/write/write_s3.htm) on form page 2 and in the biosketches (http://www.niaid.nih.gov/ncn/grants/write/write_s7.htm).

Research Plan Section I. Consultants

Careful selection and addition of consultants can add credibility to an application and greatly improve its quality. Applicants should rely on consultants to help in areas where they are short on expertise. Consultants should be credible, and the best are known experts in their field.

Include a letter describing the willingness of an investigator to participate as a consultant to the project and what his or her role will be. It is a good idea to send the consultants a sample letter

that they can return with their signature. That way, the letter will contain all the necessary information, and they will probably return it faster.

Be sure to list consultants as key personnel (http://www.niaid.nih.gov/ncn/grants/write/write_s3.htm) and provide biosketches (http://www.niaid.nih.gov/ncn/grants/write/write_s7.htm) in the application.

APPLICATION CONTENTS OTHER THAN THE RESEARCH PLAN

Congratulations! You have completed the hardest part of your application, the research plan. Now, you are ready to tackle the forms. Keep in mind that

- key personnel (http://www.niaid.nih.gov/ncn/grants/write/write_s3.htm)
- resources (http://www.niaid.nih.gov/ncn/grants/write/write_s10.htm)
- and consortium information (http://www.niaid.nih.gov/ncn/grants/write/write_q1.htm)

appear in more than one form. Make sure the information is consistent. For workers, be sure to list the key personnel in form page 2 and the biosketches

(http://www.niaid.nih.gov/ncn/grants/write/write_s7.htm), but you list all personnel in your modular budget justification (http://www.niaid.nih.gov/ncn/grants/write/write_s5.htm) page.

Though NIH says that some form pages are mandatory and some suggested, applicants are much safer either using the 398 forms or replicating them precisely. NIH provides the forms in PDF and RTF formats, which can be filled out and printed for applications. Applicants are strongly advised to use the PDF forms to avoid formatting problems with RTF that occur with some word processors. For PDF, applicants will need to buy the Adobe Acrobat software to be able to save the data. For RTF, applicants may be able to save the form in a word processor. In the PDF version, applicants can access the 398 instructions for a form by opening the plus sign next to its title. NIH also provides some examples of completed forms, such as the biosketches and modular budget.

There are two ways to access the forms. Print from the list of individual PDF forms (<http://grants1.nih.gov/grants/funding/phs398/phs398.html>) on the Web if you need only a few forms or sample forms. Or, access the full set of fillable forms (http://grants1.nih.gov/grants/funding/phs398/398_forms.pdf) (but no filled out samples). This second set is a large file, so it may download slowly.

Form Page 1: Face Page

Applicants complete parts of the face page, and the business office will prepare other parts. Visit the people in the business office early to see what information they are inserting and how much time they will need to review, add required information to, and sign the application. Applicants must have this signature before sending it to NIH.

Make the title specific and detailed. Stay within the 56-character limitation (this includes spaces).

If the application is a revision, do not change the title. If an applicant is applying for more than one award or already has one or more grants, make sure the title of the application is unique.

Form Page 2: Description, Performance Sites, Key Personnel

After finishing writing the research plan, write the abstract in the box marked "description." Make the abstract a clear, succinct summary of the project. The NIH referral officer depends on the abstract and title to assign the application to a peer review panel and to an IC. This section has a 200-word limit.

In the abstract, state the hypothesis (http://www.niaid.nih.gov/ncn/grants/plan/plan_c1.htm), specific aims (http://www.niaid.nih.gov/ncn/grants/write/write_j1.htm), and objectives, and why they are important and innovative. Tell the reviewers what potential contribution to the field and public health the project can make, while outlining the method for accomplishing the goals. Keep in mind that, if the application is funded, the abstract becomes public information in CRISP (<https://www-commons.cit.nih.gov/crisp/>), so do not include proprietary or confidential information.

In the Performance Sites section, list all sites where the work will take place. This must match the information in the Resources Format Page (<http://grants2.nih.gov/grants/funding/phs398/resources.pdf>), which details which facilities are completing which aspects of the project.

Under the Key Personnel header, list all key persons involved with the project and briefly state their role. Begin with the principal investigator, and then list in alphabetical order all other people who are contributing substantively to the research, including consultants. Each person listed should have a biosketch, which goes on the biographical sketch format page.

Form Page 3: Table of Contents

Complete the table of contents, Form page 3, after you are finished writing everything. Double check to make sure all items and page numbers correspond to those in the body of the application.

Plan the Budget

Prepare the budget after having written the research plan, and have a good idea of what the costs of the project will be. The best strategy is to request only enough money to do the work. Reviewers keep on the lookout for reasonable costs and will judge whether the request is realistic and justified by the aims and methods. Significant over- or under-estimating suggests the applicant does not understand the scope of the work. Reviewers will read the percentage of effort listed for each key person and will judge whether the figures are in sync with their expectations, based on the research proposed.

As a rule of thumb for calculating costs, figure salaries will be 60 to 80 percent of the total request, rounded up to the nearest \$25,000. Make sure the PI's salary takes into account the mandatory cap. For FY 2002, this was \$166,700. It changes every fiscal year; check the NIH Guide or the business office for the latest figure.

With a modular budget, applicants request funding in increments of \$25,000, provide few details, and budget for the entire funding period. Go the modular route for a Research Project (RO1), Small Research (R03), Exploratory/Developmental (R21), or Academic Research Enhancement Award (RI5) application requesting less than \$250,000, unless responding to an RFA or PA that asks for a detailed budget.

One major difference between modular and traditional grants is modular grants do not get annual inflation-based budget increases. This means applicants will have to build all foreseen funding needs into the request and plan for the cost of the entire project when applying. Generally, applicants request the same number of modules each year, except for special needs such as equipment.

Create the Budget

After determining the budget in increments of \$25,000, fill in the top box of the form with the requested budget for each year and the total budget. Then list personnel and consortium information under their own headers.

Follow the modular budget format page in the 398 as an example of the level of detail to include. For personnel, state the percent effort each worker will give to the job for all workers getting paid under the grant, not just the key personnel. Level of effort is not a percentage of the project, so the list does not add up to 100 percent. For example, if two investigators are each spending 100 percent of their time on the project, the level of effort for both is 100 percent.

Though applicants do not give details for most items, such as reagents or travel, figure all costs into the modular budget. One exception: specify salaries and costs, rounded to \$1,000, for consortium arrangements.

If the number of modules requested varies in any year, describe why in a separate section on the budget page (see the NIH modular budget format page for an example). For example, if you will need to purchase equipment costing more than \$25,000, create a separate module for it, and make it a one-time request so it is not added to your base amount. Applicants should avoid asking for expensive equipment unless absolutely needed. However, if asking, justify it well in the separate section. If you have listed equipment as available in the Resources section, do not request funds for it, unless you can explain why. Reviewers check such things. They will delete the funds, and your credibility will suffer. It is also best not to ask for anything that can appear to be extravagant, such as a lot of travel.

There is no budget form page for a modular grant application. If requesting more than \$250,000, prepare a detailed budget using form pages 4 and 5.

Prepare the Biographical Sketches

This section provides an opportunity to showcase the knowledge and skills of the key personnel and consultants you listed on form page 2. In this key section, reviewers look carefully to see whether the investigator and staff have enough experience with the techniques to execute the

research plan. List all staff, professional and nonprofessional, even when not requesting a salary paid from the grant monies. State the aims of all past and current related research of key personnel and include related publications. There is a four-page limit for each person with items A. and B. below limited to two pages.

Beginning with the PI, fill out the boxes at the top of the format page with names, titles, and educational history.

Then create these headers:

- A. Positions and Honors
- B. Selected peer-reviewed publications
- C. Research support

For A, give employment history in reverse chronological order, including dates, places, nature of position, professional experience, and honors.

For B, list relevant publications in chronological order -- titles and complete references (include all authors). Include accepted manuscripts but not those that are submitted, unaccepted, or in preparation.

For C, list research support either ongoing or completed during the past three years in order of relevance to the project. State the aims of all past and current related research of key personnel and include related publications. For new investigators, it is OK to not have had research support.

Do not include any pending support in that part of the application. See the biographical sketch sample form (<http://grants.nih.gov/grants/funding/phs398/biosketchsample.pdf>) as an example of what this section looks like.

Do not Confuse Research Support with Other Support

Though they sound similar, these parts of the application are very different. As part of the biosketch section of the application, *research support* highlights applicant's and colleagues' accomplishments as scientists. It is used by reviewers for the "investigator" review criterion.

In contrast, *other support* lets NIH make sure the research being proposed is not already being paid for -- which is illegal. Applicants send other support information to NIH just before they are ready to make an award. For more on what constitutes other support, see Section 3B of the 398 (http://grants.nih.gov/grants/funding/phs398/section_3.html).

Develop Other Support Information

To get an award from NIAID, applicants will have to show that no other organization is supporting the research outlined in the research plan. It is illegal for NIH to fund a project already paid for, even if the grant is not from NIH. Applicants must let NIH know of any

support they or any of the key personnel have as of the time the other support information is sent in, not the time of application. This way, NIAID will be sure to have the most up-to-date information. If applicants have no other support, enter 'none'.

If applying for more than one grant, point out in the application and in the cover letter that there is no overlap between them, and make sure the aims differ. Applicants cannot send the same application to more than one PHS agency at the same time. For the few exceptions, contact the business office for details. In addition, applicants cannot commit more than 100 percent effort to all the support. For example, if a researcher is spending 50 percent of his or her time on one grant, he or she cannot spend more than 50 percent on other grants concurrently.

Create this section with the application but do not send it in until asked -- *just in time*. If this section is sent prior to just in time, NIH may return the application with no review. State the research support at the time you are asked to send in the other support information, but do not include any pending support. NIH provides a sample filled-out form as an example.

Describe Your Resources

In this section of the application, applicants need to convince reviewers that they have the equipment, space, staff, and facilities to conduct the research. Reviewers must judge whether the project is worth the American taxpayers' investment. If the science is elegant but the applicant does not have the resources to carry it out, the reviewers will probably recommend NIH put its money elsewhere. To succeed in peer review, applicants will need to convince reviewers that their institution can provide the support needed and that it does not demand excessive amounts of their time.

State essential resources such as animal facilities or sophisticated equipment. If you are at a well-known research institution, you do not need to spell out basic items such as electricity or basic lab equipment. But if you are at an unknown research institution, do write all this out. Make sure the resources listed match the Performance Sites

(http://www.niaid.nih.gov/ncn/grants/write/write_s3.htm) section of form page 2. Here, spell out which facilities are completing which parts of the project.

Limit the Appendix and Complete Other Pages

Do not use the appendix as a dumping ground for everything that could not fit in the application. A good concept to keep in mind is, "less is more." The more non-essential information given to reviewers, the more likely they are to find a problem or something they disagree with. For example, if you have a paper that has been accepted for publication, it is safer to include a copy of the letter approving its publication rather than the paper itself. Put only necessary documents in the appendix -- those mentioned in other sections, such as the letters from collaborators.

Also, remember that only the primary reviewer will get to see the appendix -- it is not copied for the other reviewers. For details, see the Instructions for Preparing the Appendix at http://grants1.nih.gov/grants/funding/phs398/section_1.html.

Applicants will also need to complete the checklist (http://grants1.nih.gov/grants/funding/phs398/section_1.html) and personal data (http://grants1.nih.gov/grants/funding/phs398/section_1.html). If responding to an RFA, fill out the PFA label form. These are self-explanatory.

After You have Finished Writing

After finishing writing, put the application aside. In a few days, read and check it again. Most applicants find errors they previously overlooked.

As part of the review, try looking at the application from the perspective of a peer reviewer. Is the material well organized with all elements easy to find? How would you rate it using NIH's five review criteria? Does the application explain the significance of the work to scientific research progress and public health? Does it explain how your proposal is innovative? Does it make a strong case for the qualifications of the researchers and institutional support?

How about the writing and appearance? Are there topic sentences that clearly state each main point? Is the application visually appealing with white space and elements such as bullets to break up and organize the text?

Next, conduct your own peer review. Get opinions from colleagues in the field who are successful grant writers, preferably people who have been members of NIH study sections. The more critical they are, the better. It is better to know the problems before sending in the application than to learn about them from the peer review. Also, have non-experts in the field read the application to make sure it is clear and understandable. Give your reviewers at least two weeks. Then, allow yourself a full week to incorporate their suggestions.

SEND NIH THE APPLICATION

Write a Cover Letter

It is a good idea to include a cover letter with the application. The cover letter should include any of the following information that applies to the application:

- Application title.
- PA or RFA, if you responding to an NIAID initiative.
- Request of assignment and referral to an institute and study section.
- List of people who should not review the application and why.
- Disciplines involved, if multidisciplinary.
- Statement that the application was previously submitted in response to an RFA or PA.
- Statement that the required institute approval documentation for a grant over \$500,000 is enclosed.

In the cover letter, applicants can request that their application be reviewed by a particular Integrated Review Group (IPG) or study section in the Center for Scientific Review (CSR) and

an NIH Institute (IC) that might fund it. Always make sure possible competitors are not in a position to be the reviewers. In the cover letter, include the names of people you do not want to review your application, e.g., a competitor or someone with whom you have a long-standing scientific disagreement. Give the reasons for objections but focus on the positive where possible, for example, by stating the skills needed to review the application.

For multidisciplinary work, state the disciplines involved. This helps CSR properly assign your application to an IRG, if the application does not request an assignment. If you are responding to a PA or RFA and were not funded, you can send in an amended application as an investigator-initiated RO1. In the cover letter, say you are doing this and include any revisions recommended by the study section.

The Application Is Assigned to an Institute and IRG

After mailing the application to CSR, what happens next? First, CSR will give it a unique ID. Next, the application is assigned to a peer review group and an institute for possible funding. Applicants can request these assignments, or CSR referral officers will use NIH referral guidelines to determine where the application will go. If CSR gives an assignment you are not happy with, you can request a change.

Requesting IC and IRG assignments is a viable option. However, many people hesitate to do so because they feel they will do it wrong. A few years ago, NIAID looked at the data and found this is not true. In that study, CSR honored 80 percent of requests to an IRG and 87 to 100 percent of requests to an IC.

Request an Institute

Before applying, talk to a PO and do some research on the Web into the scientific areas each IC funds. Applicants can improve their chances of getting awards by requesting assignment to an IC interested in the application, one with a favorable payline, or both.

Paylines vary among NIH ICs, so a percentile not fundable in one institute may be fundable in another. Applicants will want to check which institutes are appropriate for their application and find out about their paylines. If you feel NIAID would be the best home for your application, request assignment there. See what areas of science NIAID supports (<http://www.niaid.nih.gov/ncn/staff/p-and-s.htm>) and check NIAID's paylines (<http://www.niaid.nih.gov/ncn/budget.htm>) and those of other institutes. The institutes Web sites are listed on the NIH home page at <http://www.nih.gov/>. Then, contact a PO to find out whether NIAID may have a special interest in the application.

Paylines can be somewhat deceiving. Bigger institutes generally have more money. NIAID sets a conservative funding cutoff point, called the payline, at the beginning of each fiscal year. But at end of the fiscal year, they fund some of the deferred grants, and the payline goes up.

Another way to boost funding chances is to get the application assigned to more than one institute. This way, if the primary institute does not fund it, the secondary might. Obviously, the topic has to be relevant to both institutes' scientific programs. However, there is significant

overlap among ICs. For example, if you are studying immune-mediated processes of type I diabetes, you could be funded by NIAID or NIDDK. NIAID generally awards applications in basic immunology; NIDDK funds more disease pathogenesis. A dual assignment could give applicants a chance of getting an award from either institute.

Request an IRG

Having the application assigned to the right IRG can help make sure the right people review it. Applicants can request either an IRG or a study section. Asking for an IRG lets applicants choose a group of study sections that may be friendly to the particular type of research; whereas specifying a study section lets applicants seek or exclude potential friends and competitors. NIH generally honors such requests. Even new investigator should consider requesting an IRG assignment.

Frame the request in positive terms. Say that a study section has several people who are interested in the area and are qualified to judge your work. Never suggest reviewers. If you do, the potential reviewers are immediately disqualified. (This approach has been used as a strategy for avoiding a reviewer.)

Gathering the information to make an informed request takes work, but many investigators feel it is worth it. Spend no more than an hour or two researching the interests of each study section to see where the application would best fit and look at review rosters to see who is on the committees.

Call the SRA for help in determining which study section is appropriate. Seek familiar names, and try to find a group that would appreciate the ideas. If the area seems right but you do not recognize any of the names, read their papers to see if their work is similar to yours. If they seem to be working in very different areas or likely have competing worldviews, go elsewhere. For example, if your approach is functional genomics, you do not want to be reviewed by a study section populated by cellular and molecular biologists. The level of kinship of the study section to your own work will also help guide how technically detailed you should write the application. However, it is not easy to tell who will review the application because many are now reviewed by fluid ad hoc special emphasis panels.

After notification of the assignment but prior to a review, applicants can check the committee's roster (<http://www.csr.nih.gov/Committees/rosterindex.asp>) on the Web. At that point, applicants can call the SPA if there is a major problem. For example, if there is a conflict of interest or no one on the committee is competent to review the application, you may choose to defer the review rather than be reviewed by the wrong reviewers.

When the Application is Due

Get the application in on time. Since NIH strictly enforces due dates, the application must be postmarked by the due date. The only exceptions are if there are major extenuating circumstances, such as a hurricane or other disaster. Applicants will need to have proof of mailing date: either a legible postmark or a dated receipt from a commercial carrier or the U.S. Postal Service. Always get a return receipt.

Most applications are due three times a year; ROIs are due February 1, June 1, and October 1. AIDS, small business, and some other types have different due dates. Go to the Standard Receipt Dates Review and Award Cycles (<http://grants.nih.gov/grants/funding/submissionschedule.htm>) for all NIH receipt dates. If a deadline lands on a weekend, it moves to the next business day. If unsure about the deadline, call an NIH program officer.

Since the September 11 terrorist attacks, applicants can no longer hand deliver applications.

See the 398 instructions for specifics of sending in the application, including how to copy it and how many copies to send.

The address for sending grant applications to NIH is:

Center for Scientific Review
National Institutes of Health
6701 Rockledge Drive, Room 1040 - MSC 7710
Bethesda, MD 20892-7710 (change zip to 20817 for express mail or courier service)

Avoid Having the Application Returned

NIH may return the application for various reasons without a review. The list below documents some possible reasons for application returns.

- Information included that should not be; some information is considered, *just in time*, i.e., when NIH requests it. This applies to other support and several items for human subjects research: certification of IRB approval, OHRP assurance type and number, and the letter stating all key personnel have been trained in protecting human subjects.
- Insufficient human or animal documentation, including missing data, assurances, or other required documentation (be sure to complete PHS 398 sections E and F of the research plan) (http://grants.nih.gov/grants/funding/phs398/section_1.html).
- No preapproval documentation for an application requesting more than \$500,000.
- Detailed rather than modular budget if requesting less than \$250,000, for investigator-initiated P01, R03, R21, or R15 awards.
- Improper formatting, including font size and margins.
- Hand delivered.
- Does not meet RFA or PA requirements, if responding to an initiative. (NIAID program staff decides this when they receive a copy of the application.)
- Contact of reviewer by applicant.
- Lack of required signatures.

Except where indicated, CSR determines that applicants are noncompliant when receiving the application, or reviewers do so at the peer review.

Hearing Back After Sending in the Application

Whether an applicant has requested an IRG and IC or had CSR make these assignments, they will usually hear back within ten days, though this step can take as long as six weeks. If you have not heard within six weeks, call the NIH Referral Office at 301.435.0715. Applicants and their office of sponsored research will get a computer-generated letter listing the assigned study section and institute.

Call If You Are Not Satisfied With a CSR Assignment

If not happy with the assignment made by the CSR referral officer to an IRG or IC, call the Scientific Review Administrator (SRA) to discuss an alternative. If this does not resolve the problem, applicants can appeal to the director of receipt and referral, CSR, Suzanne Fisher, at 301.435.0715.

For more information, see CSR's "A Straightforward Description of What Happens to Your Research Project Grant Application (R01/R21) After It Is Received for Peer Review" at <http://www.csr.nih.gov/REVIEW/peerrev.htm>.

You May be Able to Send in Additional Data

If you have gathered additional data between the time you sent in the application and the review, you may be allowed to send it late. Call the SRA to determine the deadline; these procedures vary among study sections. The SRA can also tell you whether you need to send in any supplemental information. However, be aware that reviewers are under no obligation to review late material, and it could reflect either positively or negatively on you.

WHAT TO DO IF YOU DID NOT SUCCEED

If Your Score Was Not Fundable or You Were Not Scored

What if you submit a grant application to NIH and it does not get funded? Competition has become increasingly tough, and it is very common not to succeed on the first attempt. The good news is that more people succeed on their second try than on their first; and still more on their third. Over half of all NIH applicants eventually get funded.

Be prepared to have to try again - consider resubmission the next logical step in the process. Because success falls off rapidly after the third try, NIH limits applicants to two resubmissions. Even then, there may still be hope -- see our article, "Did Your Application Get Three Strikes? You are Not Necessarily Out!" (<http://www.niaid.nih.gov/ncn/newsletters/nl021501/nl021501.htm>)

Feeling frustrated or angry is a normal response to a lack of funding or to not being scored. However, applicants should wait until they can address the situation calmly and objectively before deciding what to do next. Below are some possibilities for those who are not funded.

Ask if it is Fixable?

There are three types of problems with unfunded application:

1. Fixable problems.
2. Fatally flawed.
3. Lack of reviewer enthusiasm (dull topic).

Before deciding what to do, applicants need to determine whether the application's faults are fixable and how appropriate the reviewers were. Spend some time analyzing the results and gathering as much feedback as possible from the summary statement, the PO, and senior investigators at your institution. If the problems are fixable, it is worth revising the application.

Call the Program Officer for Feedback

After receiving the summary statement, read it carefully several times. Then, call the PO to see if he or she can provide more feedback from the review. Program staff often attend review meetings as observers. If the PO was at the review meeting, he or she may be able to give you more insight into the discussion. For example, the PO may know the general feeling reviewers seemed to have about the application or points not addressed in the summary statement.

Assess How Serious the Problems Are

To begin figuring out whether to revise the application or start over with a new idea, applicants will have to assess the nature of the problems the reviewers noted at the initial peer review. Read the summary statement carefully and analytically, keeping in mind that it is not an exhaustive critique. It is a paradox, but faint praise can be a worse sign than abundant criticism. Applicants should be concerned if reviewers had no major criticisms of the application yet still gave it an unfundable score. Often this means reviewers were not enthusiastic about the ideas in the application. If this is the case, revising will not help -- start over with a new idea. If you get this feedback, do not shoot the messenger. It is better to find out at this stage than to keep trying with a doomed idea.

Surprisingly, it is usually a good sign if reviewers pointed to many fixable problems. It often shows they are interested in the idea and are indicating it is worth revising. Ask the PO for more feedback on the level of reviewer enthusiasm.

Summary Statements Have Their Limitations

Applicants can correct all the problems in the summary statement and still not get a fundable score. Why? A summary statement is not an exhaustive critique of the application, and it is not meant to be a teaching tool. Instead, it hits the highlights as far as the review progressed. Reviewers spend up to 10 to 15 minutes discussing each application. Once they have found a fatal flaw, they stop discussing the application. The flaw could be something as simple to correct as not protecting the safety of lab workers or animals, or it may be a truly fatal flaw such as an unprovable hypothesis.

Once the reviewers stop discussing the application, their feedback ends, and you have no way of knowing what else they may have found had they continued. Further, the next review may have new reviewers who may view your project differently.

If You Were Not Scored, You May Be Able to Revise

If your application was not scored, it does not mean it was necessarily a terrible application. Some unscored applications may be of higher quality than others that received a score. Because they do not benefit from a full review, it is much harder to get a sense of the reviewers' appraisal of the merit. So if your application was not scored, you will have to do even more sleuthing to figure out what to do next.

Just as is the case for a reviewed application, your unscored application could have had a fatal but fixable flaw that reviewers felt put it in the lower half of the applications they scanned before the review. The task is to figure out the seriousness of the problems. Read the reviewers' critiques carefully, and get advice from the PO and experts in your institution.

Common Fixable Problems

Problem: Poor writing.
Solution: Rewrite, get help.

Problem: Insufficient information, experimental details, or preliminary data.
Solution: Assess what is missing; add it to the research plan.

Problem: Significance not convincingly stated.
Solution: Beef up that section; show importance to NIAID mission, public health.

Problem: Research not shown to be feasible by the proposed staff.
Solution: Get consultants with the required expertise.

Problem: Insufficient discussion of obstacles and alternative approaches.
Solution: Write what you will do if you get negative results or an approach does not pan out; include decision trees.

Problem: Reviewers are not interested in the subject.
Solution: They are not the proper peers; request a different review group.

Not Fixable or More Difficult Problems

- Philosophical issues, e.g., the reviewers do not believe the work is important (assuming they are qualified to make that decision).
- Hypothesis is not sound or not supported by data presented.
- Work has already been done.
- Methods proposed were not suitable for testing the hypothesis

If Problems Are Fixable, There are Several Options

If you determine that your problems are fixable, you have four options:

1. Revise the application and resubmit it to the same study section.
2. Revise the application and resubmit it to a different study section.
3. Create a "new" application out of the original one and request a new study section.
4. Create a truly new application.

To gauge whether an application would be considered "new" or revised, use this rule of thumb: if you revise more than 50 percent, it is a new application. If less, you must follow the rules for a revised application.

Option 1: Revise and Resubmit to the Same Study Section

If reviewers thought the basic idea was interesting and important but found fixable problems, the application is likely worth revising. Revising allows applicants to retain most of the original application, while addressing the reviewers' concerns.

Revising and resubmitting to the same study section can be advantageous. The study section must look at the application in the context of their critiques, so this approach works well if their concerns can be readily answered.

This route is the most common one and works well when the points of contention are limited. Discuss each of the reviewers' points one by one, and show clearly in the text where there have been changes; for example, using brackets, indents, or some other marker (not color because the application is photocopied). Include any new data, and strengthen the application wherever possible.

Option 2: Revise and Resubmit to a Different Study Section

Follow the advice for option 1, but also request a change of study section if there are major reservations about the reviewers' understanding of the proposal.

Did the study section's interests match those of the application? Were the members comfortable with the research methods? If not, the wrong group reviewed the proposal. Look for a study section that best matches the topic and approach and request CSR to assign your application there. Frame the request in positive terms, even if you believe there was a problem with one of the reviewers. For example, say that another study section has several people on it who are interested in your area and qualified to judge your work. State the reasons for the request, e.g., lack of interest, differing philosophies (a molecularly oriented review group reviewing a clinical application). Although you may request a new study section, NIH is not obligated to honor these requests, although it usually does. Never suggest reviewers

Option 3: Revise, Request a New Study Section, and Create a "New" Application

If the study section missed the point of the application, but you feel secure about the proposal, consider requesting a new study section and creating a "new" application.

Going this route, reviewers will not see the summary statement from the study section, so applicants get a fresh start. The grant title should be changed and some of the aims should be revised. Changing the title is key so that when the application is logged in, the NIH computer does not recognize it. But beware of just changing the title and not revising the application. Not only is this against the rules, but if the application ends up with the same study section - which can happen -- committee members will probably recognize it and be angry if it is not significantly changed. Be sure to include any new data in the revised application, and strengthen it wherever possible. Talk with the program administrator for more advice on executing this approach.

Option 4: Create a Truly New Application

If the problems were serious, rethink your idea. Propose a new concept, keeping what material can be salvaged from the previous application.

Get advice. Ask someone in your institution who is experienced in grantsmanship and not involved in your proposed research to review your application and summary statement and help with revision plans.

Even if you salvage parts of the original application, always use a new title so that NIH's electronic system does not mistake the new application for the old one.

Appealing a Review

Rather than appealing a review, we recommend revising and resubmitting the application. Appeals almost always end up with the applicant revising and resubmitting the application anyway. When appealing, applicants go through a lengthy appeals process and end up doing what they would have done in the first place; so why waste the time?

Regardless, applicants can appeal only for defects in the review procedure; for example, conflict of interest or bias, not differences of scientific opinion. If you want to appeal, call your PO.

You Can Revise Twice

Most applicants do not succeed at first try -- so they try again. And many people succeed on the second or third try.

NIH allows two revisions within two years of the date the proposal was originally submitted. If you do not succeed by then, change the title -- so NIH recognizes it as new -- and revise the application significantly.

Respond to Reviewers' Comments

Once the application has been through review, applicants play by new rules. They are now required to address all the concerns from the last review in the revised application. Reviewers will check to make sure this has been done. Help them find what is new by clearly marking all

new text using visual aids such as arrows, indents, bars in the margin, bolding, or change of type. Do not use color to indicate changes -- it will not photocopy.

That said, compliance is not a guarantee of success. Reviewers are not wedded to the previous reviewers' critiques and can raise new criticisms or even disagree with previous comments.

Read and reread the summary statement. Identify the problems. Talk with the PO and experienced grantees to get advice. Though applicants must revise items mentioned in the summary statement, they are not limited to those items. The PO may be able to give more insight into the discussion at the review meeting.

Applicants must respond to the comments and suggestions of the reviewers point by point, even if they disagree with them. If you disagree, explain why and provide additional information, if needed. Even better, change the proposal. For example, if a reviewer does not like an approach, propose a different one. Be sure to include any new preliminary data gotten since the review.

If applicants responded to an RFA or PA and were not funded, they can submit a revised application as an investigator-initiated RO1.

Include a Revision Introduction

When sending in a revised application, applicants must include a three-page introduction to the research plan as part of the application. The three-page introduction does not count toward the application page limit. In it, applicants respond to reviewers' comments by describing how they have substantially changed the application and addressed the criticisms outlined in the summary statement. They can also add any new findings they have since sending in the initial application, or make additional revisions they feel would be helpful. See the PHS 398 for other instructions.

Why You Still May Not Get Funded

Applicants can correct all the problems in the summary statement and still not get a fundable score. Why? First, a summary statement is not meant to be an exhaustive critique of the application. If overall enthusiasm for the proposal is low because it is seriously flawed, no amount of revising will help, even if the points in the summary statement are addressed.

Also, when making changes, applicants risk introducing new problems. Finally, IRG membership changes; the application may be seen by new reviewers who may have different reviews of the project. So even if you have tackled all the issues in the summary statement, the reviewers may come back with new ones.

The best way to deal with this is to get lots of help and feedback to ensure sending NIH the strongest application possible. Consider the reviewers comments to be invaluable, but go ahead and get a thorough critique from peers and mentors. And talk to the PO for more feedback.

If you still do not get funded after the second try, try again! NIH allows applicants to revise and resubmit the application for review two times within two years of the first application.

For More Information

For more information on grants, including a list of funding sources, go to the Web site for the UM Office of Sponsored Projects Administration at <http://www.ospa.umn.edu>.