
How to Write a Successful Grant Proposal: Problems and Solutions

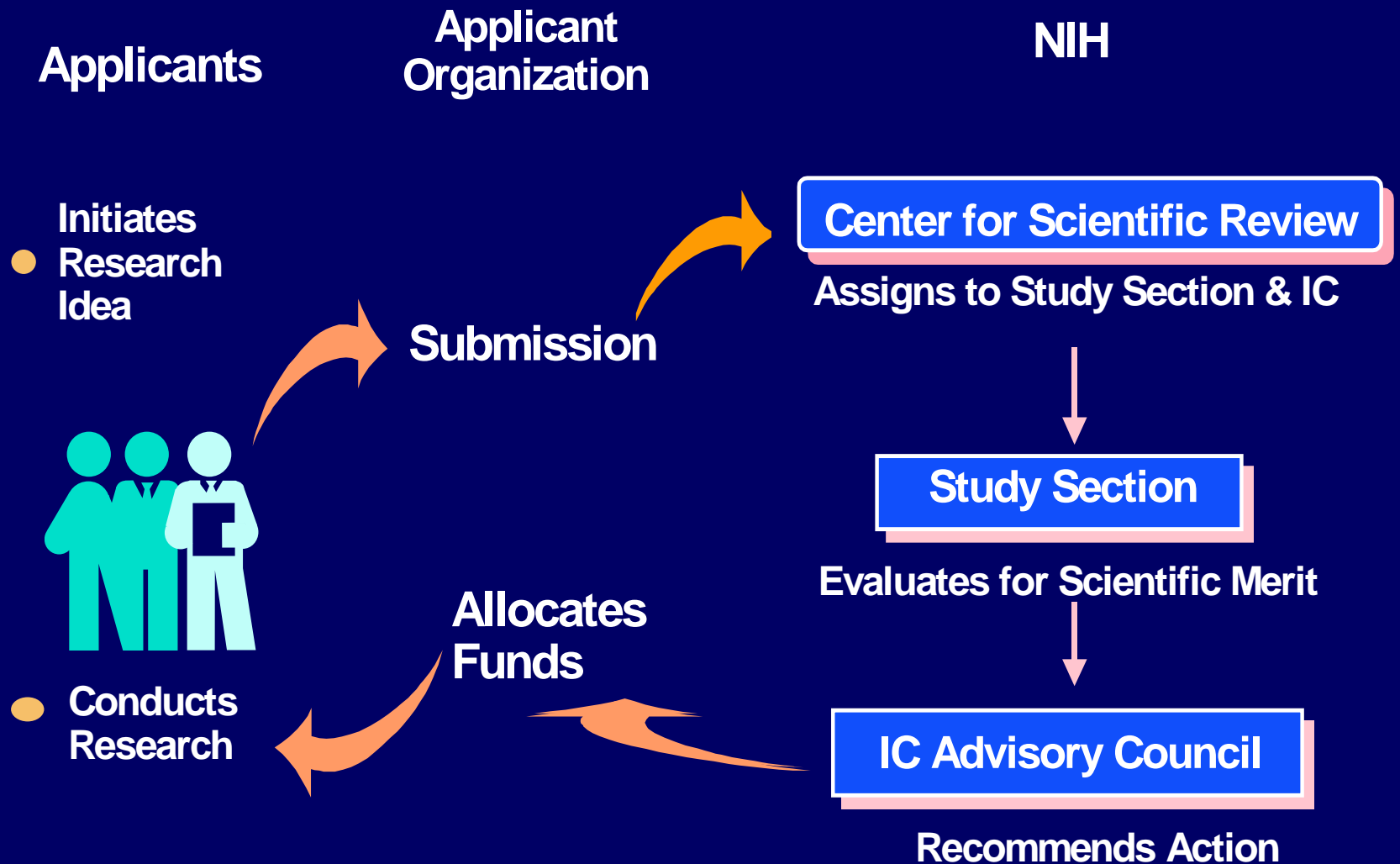
How to Write a Successful Grant Proposal: Problems and Solutions

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Pursuing for Grant Funding Is Competitive

- **More than 50,000 applications are received by the NIH each year**
- **The success rate is about 25%**
- **About 40% of applications are unscored**

Review Process for a Research Grant



Common Mistakes in Grant Application

1. Problems in presentation
2. Scientific flaws

Common Mistakes in Grant Application

Problems in presentation:

- Poorly organized
- Language errors and incorrect formatting
- Clarity problems

Problems in Presentation

Problem: Poorly organized

Solutions:

- **Think logically:**
 - **What is the problem which need to be studied?**
 - **Why this issue?**
 - **What is your hypothesis?**
 - **What are your results supporting your hypothesis?**
 - **How can you demonstrate your points?**
 - **Which methods can you use?**
 - **What are difficulties and how to overcome them?**
-

Problems in Presentation

Problem: Poorly organized

Solutions:

- **Outline the whole proposal clearly before write**
- **Explain science clearly (don't assume reviewers know everything)**

Problems in Presentation

Problem: Language errors and clarity problems

Solutions:

- Use concise and clear language
 - Read at least 3 times before submitting
(don't rely solely on computer spelling and grammar check)
 - Ask somebody with good writing skills to check English
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Problems in Presentation

Problem: Incorrect format

Solutions:

- **Follow instructions for PHS 398**
 - **The height of the letter: not smaller than Arial-10 or Times New Roman-12 point**
 - **Type density: no more than 15 characters per inch including characters and spaces**
 - **Vertical density: no more than 6 lines of type within a vertical inch**
 - **Margins: at least 0.5 inch (suggest: 0.75)**
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Scientific Flaws

1. General

Selecting project

Developing hypothesis

Setting the research objective

2. Abstract

3. Specific aims

4. Background and significance

5. Preliminary data

6. Research design and methods

7. References

Scientific Flaws in General

Write a proposal in two weeks? Never do it!

Solution:

- 1. Plan to write your grant as early as possible**
 - 2. Never submit your application if it is not your best effort**
 - One application can be revised only 2 times**
 - A failure will produce a bad record**
 - Revision will take at least 6 months**
 - 3. Leave enough time for modification**
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Selecting Project

Ideal Project:

- **Important and needed**
 - **Novel**
 - **Not too much controversy**
 - **You have a strong background**
 - **Doable**
 - **Large room for new methodology**
 - **You have plenty of preliminary data**
 - **Easy to establish a collaboration team**
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Selecting Project

Common Mistakes

- “I like this issue”

Should be based on significance, not on your interest

- “Although this is not new, I have been doing this for years”

Innovation is critical

- “Although it is controversial, I can resolve it”

Should avoid too much controversy

Selecting Project

Common Mistakes:

- “This issue has not been studied”
Should be based on actual need
 - “I select this project because it doesn’t need new methodology”
Should select a project that can use new methods
 - “This issue has been resolved in other cell types, but this is new to my cell type”
Innovation will be questioned
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Hypothesis

Most grant applications must be hypothesis-driven

An Ideal Hypothesis:

- **Hypothesis should be innovative or will significantly advance the knowledge of the field**
For biomedical research, it should increase understanding of normal biologic processes, diseases, or treatment and prevention
 - **Testable by current methods**
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Hypothesis

Where is the place to describe hypothesis?

- 1. Abstract (1 sentence)**
- 2. Specific Aims (a few sentences)**
- 3. Experimental Design (in detail)**

Key: keep consistency

Research Objective

What is the objective of a project

- It is not long-term goal, but is the a step toward the long-term goal
 - It defines the purpose of the proposed research
 - It should be phrased in such a way that the central hypothesis clearly grows out of it
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Research Objective

An Ideal Research Objective:

- **Hypothesis-driven**
- **Innovative**
- **To study mechanisms**
- **Realistic and focused**
- **Doable in the requested budget and time**

Research Objective

Common Mistakes 1. “Too ambitious”

Solutions:

**Focus on one important issue and study
underlying mechanisms**

Research Objective

Common Mistakes 2. “Technology-driven”

If an application is not to study a technology or method, it should not be technology-driven. Using a technology is not a purpose, but a measure

Solutions:

- 1) Develop a hypothesis**
 - 2) Select necessary methodologies which are necessary to demonstrate the hypothesis**
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Abstract

- **Very important (some reviewers will evaluate your application mainly by reading Abstract and Specific Aims)**
- **It should summarize the whole application**
- **Use concise and clear sentences**
- **Emphasize the specific aims**

Abstract

How to do it?

- **Clearly state your long-term goal**
 - **Review the background of this area and unsolved problems**
 - **Clearly state your objective(s) of this project and why you select this objective**
 - **Summarize your specific aims and anticipated results**
 - **State the significance of this project**
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Specific Aims: General

- **Most important part: the overview of the whole project**
 - **Should be 2 to 5**
 - **Not descriptive, study underlying mechanisms,**
 - **In logical order**
 - **Test the hypothesis collectively**
 - **No aim should depend on another aim's outcome**
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Specific Aims: Example

To study the effect of a new protein on bone resorption

Specific aims:

- 1. To characterize the effects of the protein on osteoclast formation and activation**
 - 2. To elucidate the intracellular signaling mediating the effects of the protein**
 - 3. To test the effect of the protein in animal models**
 - 4. To confirm the effect by blockade of this protein (antibodies, knockout)**
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Specific Aims: How To Do It? (1)

Linkage is the key

Paragraph 1. Introduction

- **Opening statement**
- **What are known**
- **What are unknowns (gaps)**
- **Frame the problem which is most important**

Paragraph 2. Goal, objective and hypothesis paragraph

- **Long-term goal**
 - **Objective of this project**
 - **Hypothesis (sometimes how developed)**
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Specific Aims: How To Do It? (2)

Paragraph 3. Individual aims

- Concise and clear words
- Cover the experimental designs and methods
- Don't overstate them
- Should not contain comments

Paragraph 4. Significance

- How innovative
 - Expected results
 - Impact
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Background and Significance

Purpose:

- 1) To frame the problem needs to be resolved;
 - 2) To demonstrate the significance of the project;
 - 3) To justify how you developed your hypothesis.
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Background and Significance

Problems:

-- Too broad and not focused,

Solution: only review the related materials

-- Never frame the problem.

Solution: clearly state what the problem is

-- Too many references

Solution: cite only critical papers

-- Ignore the critical or new reports

Solution: cite newest and influential references

Preliminary Studies

Purpose

To demonstrate

- 1) your hypothesis is correct
- 2) you have the ability, methodology and equipment to do it

Preliminary Studies

Problem 1: Not enough data

Solution: 1) Wait for next cycle
2) Apply for smaller grants, R21 or R03

Problem 2: Data are not solid

Solution: Don't use them.

Problem 3. Showing too much data

Solution: Select best data to show. Focus on the goals; 1 or 2 figures or tables for each aim

Preliminary Studies

Problem 4: Data are poorly presented

Consequences: 1) Difficult to follow you;

2) Conclusion will be: you are unable to analyze and present your data

Solutions:

- 1) Organize data in the same order as specific aims
 - 2) Right style and size (easy to understand)
 - 3) Clearly explain the experiments and the labels in legends
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Preliminary Studies

Further Suggestions:

- 1) Always use clear figure legends
- 2) Use original pictures for all copies of application if color pictures are used

Research Design and Methods

Common Mistakes:

- Too ambitious
- Descriptive
- No anticipated results
- No alternative plan
- Inappropriate methods

Research Design and Methods

Problem 1: Too ambitious

Solutions:

- 1) Calculate the work amount
- 2) Focus on one critical issue

Research Design and Methods

Problem 2: Descriptive

Solutions:

- 1) Select one important issue**
- 2) Study the underlying mechanism**
- 3) Delineate the issue completely**

Research Design and Methods

Problem 3: No anticipated results

Solutions:

- Describe what results you expect to get
 - State the weakness of the design and methods
 - List potential problems and Anticipated difficulties
 - Predict the impact on the whole project
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Research Design and Methods

Problem 4: No alternative plan

Solutions: Design solid backup plan

How to do it:

- Only for critical issues
 - Clearly explain your alternative studies
 - Use reliable and predictable design
 - Don't use risky procedures
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Research Design and Methods

Problem 5: Inappropriate methods

Solutions:

- Always use cutting-edge technology**
 - Clearly describe methods**
 - Discuss strength and weakness of the methods**
 - Plan backup methods if risky procedures are used**
 - Use more than one methods for critical studies**
 - Develop collaborations if you don't have a strong background for some methods**
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Research Design and Methods

Common Mistakes in Choosing Methods

- Not using cutting-edge technology
- Misusing methods
- No details for methods
- Too much details for auxiliary methods

Research Design and Methods

Problem 1: Not using cutting-edge technology

Solutions:

- Learn and use new technology as much as possible
 - Never reset your goal to a lower level because of the lack of expertise and experience
 - If you need some new methodologies, establish a collaboration team, such as, invite co-investigators or consultants, or develop a sub-project
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Research Design and Methods

Problem 2: Misusing technology

Solutions:

- Fully understand all the methods you use**
- Don't use a method you don't really need**
- Don't use a method solely because it is fancy**
- Don't use a method which is in controversial**

Research Design and Methods

Problem 3: No details

Solutions:

For a new method

- Provide technological details, i.e., procedures**
 - Discuss strength and weakness of the method**
 - Show your experience in using this method
(cite your publications)**
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Research Design and Methods

Problem 4: Too much details for auxiliary methods

Solutions:

If it is a frequently used common methods, don't need details; e.g., “protein content will be determined as described by Lowry et al (1951).”

References

Problem 1: Too many references

Solutions: Select related, new, and influential papers to cite. Reference number should not over 100 for R01 application

Problem 2: Incorrect references

Solutions: Search the whole area and select critical papers

References

Problem 3: Unclear format

Solutions: List references numerical or alphabetical and clearly cite them in the text

Problem 4: Incorrect citing

Solutions: Check the list and citing carefully

Collaboration

For collaborations, attach a letter of consent to the PI:

- **From each co-PI or consultant, not from their organizations**
- **Letters should clearly state the willingness of participation, the collaborative work, and the expertise or methodologies or equipments provided**

Budget

Mistakes: Too large or too small

Solution:

- Understand that budget size will not influence your score
 - Calculate your cost correctly
 - Request in modules
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Other Solutions

- Find out who are Scientific Review Agent (SRA) and reviewers from CSR Home Page - <http://www.csr.nih.gov>
 - Write a cover letter to request that certain people NOT review your application
 - Request the assignment of your application to a particular Institute and/or IRG. If you have been in contact with a program staff, mention this by providing name and telephone number
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Good Luck!