# Writing Research Proposals to Plan and Persuade

*This handout offers students an introduction to writing research or grant proposals in order to persuade an audience of the credibility, feasibility, and impact of their ideas. Students working with this writing genre as part of a course assignment may have guidelines or requirements that differ from those described here.*

## Introduction

Funded research proposals - also called grant proposals -, are detailed plans for why and how to carry out research paid for by someone else. A grant proposal is similar to a thesis proposal in that it lays out a plan and rationale for a research project but differs in that its goal is to not only to obtain approval for performing research, but also to win the requisite funding for it. Grant proposals constitute a special subclass of proposals because they are submitted to funding agencies for review as part of highly competitive contests with often large monetary rewards. Effective proposals, therefore, are essential to sustaining a successful research career, as they cover research costs, sometimes including the researcher's salary.  While they vary in length based on funding agency guidelines, most proposals are lengthy documents of 10-20 pages plus references and appendices.

## Purpose

Grant proposals are the central medium through which researchers and scientists procure funding and approval to perform research. To receive funds, a grant proposal must persuade readers the proposed work is significant, fills an important need, and shows a good match with the funding organization's mission and goals. Because funding agencies often distribute research funds in chunks over annual or biannual increments, grant proposals must also convince readers that the project can be completed within the stated budget and time frame. Ultimately, grant writers must convince the funding agency that the research outcomes obtained by end of the project timeline will have an impact in the field or on society at large.

## Grant Rhetoric

Grant proposals are different from most forms of technical communication in that their style is explicitly persuasive rather than neutral. Crafting effective proposal rhetoric requires writers to be extremely knowledgeable about the goals and expectations of their audience of reviewers. The goal is not just to explain what the proposed research will entail, but also to convince readers that the research is important, feasible, and that the author is the right person to conduct it.

An effective grant writer creates a proposal that: (1) matches the funding organization's goals, (2) conveys strong research objectives on the first page, (3) tells a compelling research story, (4) details sound logistics for executing the research plan, and (5) adds credibility to the research proposal in every section.

**1. The research must match the funding organization's mission and goals.**
It is important that the outcomes of the proposed research align with the mission and goals of the funding agency to which the proposal is sent. If the work does not interest the funding agency, it will likely be rejected. Almost all funding agencies or foundations will have a guiding mission or vision statement published on their website, and individual grant solicitations can have even more specific research goals and criteria.

Understanding the funding organization's specialized motivations can help grant writers tailor their research objectives to better meet the funder's objectives and increase their probability of winning funding. Some of the most common, and indeed largest, sources for research funding are federal agencies such as the National Science Foundation (NSF), National Institutes of Health (NIH), U.S. Department of Defense (DoD), U.S. Department of Energy (DoE), and the National Aeronautics and Space Administration (NASA). A project, for example, that aims to determine the habitability of oceans on the icy moons of Jupiter would have research outcomes better aligned with NASA's vision to "reveal the unknown for the benefit of humankind" or the NSF's broader mission to "promote the progress of science" than the NIH's mission to gain and apply "knowledge to enhance health, lengthen life, and reduce illness and disability." Some federal agencies have subgroups called "Institutes" or "Offices" that provide specific funding opportunities to advance a more focused mission or set of goals. Smaller foundations will have a similarly narrower focus for research funding opportunities. For example, the Cystic Fibrosis Foundation is a private foundation that offers research grants only for basic science research on cystic fibrosis pathogenesis and no other disease pathology. A great tool for researchers and grant writers is the website http://www.grants.gov, a thorough and frequently updated web resource for information on the grant process and federal funding opportunities.

Often, funding agencies will solicit proposal submissions with a request for proposals (RFP) that details the areas of research that they seek to finance. RFPs will also detail any specific formatting and content requirements and should be studied and followed exactly. If the research does not align with the funding agency's goals, find another organization or grant solicitation with a better match. Most academic institutions have an Office of Sponsored Research or similar department to provide assistance in finding research funding opportunities and preparing proposals.

**2. The first page is the most important part of the proposal.**
Due to the grant proposal's length and large scope, the first page must summarize the research plan and objectives in an **Abstract** and a summary of **Specific Aims.** Grant reviewers are often tasked with simultaneously reviewing large numbers of proposals, the majority of which they cannot fund. Given the limited number of hours in the day, reviewers must quickly locate and isolate the proposals with the greatest potential from the rest of the stack. Reviewers typically judge the value of reading the full proposal by scientific merit and readability of the first page, so it must provide a concise, standalone preview of the contents of the full proposal.

The Abstract should succinctly summarize the technical research plan contained within the following pages of the proposal. It should include the motivation for the proposed work, the specific question or knowledge gap the work will answer, the research approach and methods to be used, the anticipated research outcomes, and their significance. The Abstract should be roughly one paragraph long. *See the Hixon Writing Center handout on Writing Effective Abstracts on the Resources webpage for more information: https://writing.caltech.edu/resources/abstracts*

Research is often motivated by an overarching question, hypothesis, or goal. The Specific Aims should take the overall goal or question of the research and break it into concrete tasks, objectives, or phases, each of which has outcomes and/or deliverables that align with the funding agency's goals. For the above NASA project example, the motivating research question might be "Are there habitable oceans on the icy moons of Jupiter?" In order to answer this broad question, specific data must be gathered to complete an objective or test a hypothesis. An example objective might be, "Determine chemical composition of the ocean beneath the moon's icy crust," and a testable hypothesis, "The oxygen-to-hydrogen ratio in the subsurface ocean can support life." Each of these questions can be explored as a Specific Aim. Each Specific Aim should include: a focused hypothesis or objective, discretized experiments to test the hypothesis or complete the objective, predicted experimental outcomes, and the significance of those results in regards to the overarching research question.

Alternatively, some grant solicitations request an **Executive Summary** that expands the Abstract and Specific Aims up to roughly three pages. If these initial sections are not written clearly or the research ideas are not communicated effectively, reviewers will not read past the first page. To further help reviewers navigate different sections of the grant, proposals often include a **Table of Contents**. Be sure to follow the guidelines provided by the funding organization exactly.

**3. The research narrative creates a compelling story for the proposed work.**
Following the Abstract and Specific Aims, the research narrative details and provides context for the approach, expected outcomes, and impact of the proposed work in different sections. Similar to a research manuscript, the narrative includes an **Introduction** section that provides the necessary technical background and open research questions that motivate the work. Some proposals may include a **Preliminary Results** section, which is similar to a manuscript-style results section and demonstrates the project's momentum to help make a case for its likely success.

The main body of the proposal consists of the **Research Plan** and proposed methodology. This content is often broken up into sections dedicated to each Specific Aim. The technical content should possess a level of detail sufficient for educated reviewers to assess the feasibility and appropriateness of the approach. Furthermore, a strong proposal also identifies potential pitfalls in the approach and addresses suitable alternatives – or the rationale for not pursuing those alternatives. To enhance readability and ensure that the reviewer does not miss or misinterpret information, grant writers will often explicitly state the strengths of their research approach. For example, the innovative approach for determining the habitability of icy moons could be explicitly highlighted by staying, "To accomplish our second specific aim, we employ a novel thermal fracturing model to calculate hydrogen production rates on Europa. This method allows us to determine for the first time the geophysical contributions to chemical disequilibria, a key requirement for life." Proposers use language such as "novel," "for the first time," and "key" to persuade reviewers of the innovativeness and significance of their approach.

Finally, the **Significance** and **Impact** of the expected outcomes are addressed and connected to the funding organization's goals and mission. For example, the significance of research completing the Specific Aims outlined above could be described as indication that the icy moon Europa is one of the most compelling locations in the solar system for extraterrestrial life. A revelation of this type would be of interest to both NASA and to the public. When each of the elements of a proposal – the motivation, the approach, and the significance – are presented in this predictable and logical order, the proposal has a narrative flow. This scientific "storytelling" makes it easier for the reviewer to read and understand the merits of the proposed work from start to finish. When these elements are missing or out of order, it is difficult for the reviewer to follow the writer's logic, and the proposal loses credibility.

**4.  Proposals must have thorough and realistic logistics.**
Reviewers are skeptical readers. It is incumbent upon the author to persuade them that, not only is the research is compelling, it can be accomplished in a timely manner by the author.  As such, proposals are also judged on the soundness of their logistics for executing the research plan. To provide evidence in support of their feasibility, proposals also contain a **Management** section that justifies the answers to the following questions:
- Who will do the work? Are they qualified?
- Where will the work will be done? Are the facilities sufficient?
- What is the timeline for the proposed objectives and their resultant deliverables?
- What funds are required to conduct the research and support the researchers?

To provide evidence to answer questions, grant writers include **Supporting Documents** in order to increase the proposal's credibility and demonstrate a high probability of achieving the Specific Aims. A **Budget** is required to justify the proposer's monetary request for nearly all grant proposals. Check with the funding organization, as they usually have specific required forms for the budget and related management sections. The proposer and collaborators' curriculum vitae might be included to demonstrate appropriate expertise in research areas relevant to the project, adding further credibility to the grant proposal. By also including a list of other relevant grants won and resulting publications, the proposer can demonstrate that they have a history of successfully completing research objectives. Letters of reference or support from institutions or collaborators help convince reviewers that there are sufficient resources available to successfully complete the proposed work. Finally, an **Authorization Page** signed by a qualified representative at the proposer's institution is required by most funding agencies.

**5.  Every part of the document should add to the research proposal's ethos.**
Research proposals are a conglomeration of multiple technical documents – abstracts, research narratives, budgets, curriculum vitae – all of which must serve to build the credibility or *ethos* of the proposed work and its proposers. A strong ethos supports the *logos*, or logical reasoning, of the proposed research, increasing the likelihood of winning funding. Writers build ethos using the following tactics:
- *Make clear, evidence-based claims* to persuade readers that the proposal has scientific merit, but avoid speculation and hyperbole. Include data and discussion in the Preliminary Results to show that the research is feasible and the project has momentum. Ensure that the proposed work is outlined in logical steps within a reasonable timeframe and budget.
- *Highlight innovation* by using phrases such as "novel approach" or "for the first time." Showing readers the proposal's innovation and creativity can be particularly effective for obtaining funding early as a "Young Investigator" or for winning a grant for the first time.
- *Establish expertise in all technical areas required in the research plan.* Include the curriculum vitae of the principle investigator and collaborators, and letters of support from collaborating personnel, institutions, research centers, or facilities that will be needed for the research.
- *Demonstrate a history of successful research.* Including a list of the proposer's relevant publications and previously awarded grants can help build trust with the reviewers. A proposer's ability to publish past research suggests a high likelihood that they will successfully execute the research plan under review.

Through the many different documents of the proposal, the writer crafts a story where the research motivation is clear and shared by the funding agency, the research path is supported by the ethos and logic of the proposer and collaborators, and the research outcomes will make an impact in the field under discussion.

**Summary**

A research proposal is a comprehensive package of information that not just tells, but sells, a research idea and a plan to investigate it. Proposal writing is persuasive writing that uses technical information as evidence in support of the specified research objectives and approach. The proposal uses clear, concise, and precise writing that is easy for an audience of educated reviewers to understand. A successful proposal convinces the reader that the proposed work is valuable, fills a need, has a reasonable approach, budget, and timeline, and will make an impact aligned with the funder's mission.

**Writing Checklist**

**Does the proposal contain all of the required sections?**
- ❑ Abstract
- ❑ Specific Aims / Executive Summary
- ❑ Table of Contents
- ❑ Background / Introduction
- ❑ Significance / Impact
- ❑ Preliminary Results (if applicable)
- ❑ Research design / Plan / Methodology / Approach
- ❑ Potential Pitfalls and Alternatives (aka "Worst Case Scenario" outcomes)
- ❑ References
- ❑ Budget
- ❑ Personnel / Team qualifications

**Rhetoric: Are the key elements of the proposal convincing to its intended reader?**
- ❑ Is the project objective clearly and succinctly stated?
- ❑ Is the significance of the proposed work explicitly stated? Is it convincing?
- ❑ Does the nature of the proposed work align with the mission and the philosophy of the funding agency, and does the proposed work match the goals of the request for proposal (RFP)? Is this match clearly communicated?
- ❑ Is the proposed plan, in particular the Abstract and Specific Aims (or Executive summary), accessible to an educated non-expert?

**Writing: Is the writing well organized, clear, and correct?**
- ❑ Is the flow of proposed aims clear and logical?
- ❑ Are transitions between the sections used, and do they make sense?
- ❑ Are the key terms used throughout the proposal consistent across paragraphs and sections? Are key terms clearly defined as needed?
- ❑ Is the writing precise and concise?
- ❑ Does the document consider ease of readability? Specifically: Is there only one idea discussed per sentence? Are the sentences short to medium in length? Are action verbs used? Is the document free of grammatical, spelling, and punctuation errors?

**Technical Checklist**
- ❑ Does the difficulty of problem adequately match the skills of the proposer(s), the timeline and budget specified?
- ❑ Is the proposer familiar with the literature, prior works, and current state of the art?
- ❑ Does the proposer provide sufficient evidence to substantiate their objective?
- ❑ Do they have a sound hypothesis or objective?
- ❑ Is the proposed research plan or design built upon a firmly developed scientific basis?
- ❑ Are the materials, methods, and procedures suitable for achieving the objective?

- ❑ Does the approach demonstrate scientific imagination or particular insight?
- ❑ Are statistical analyses sufficiently considered, when applicable?
- ❑ Will the final outcome(s) of the work have sufficient impact? Has a dissemination path been identified? Have potential pitfalls, alternatives, and worst-case scenarios been discussed?
- ❑ Is the proposed timeline and budget adequate and realistic to achieve the proposed measurable outcomes?
- ❑ Will the proposer have access to the materials and support required to complete the objectives?

**For more support:**
[Caltech Office of Sponsored Research](#)


**Works Consulted**
We consulted a number of works on this topic to create this handout, and you'll find their references here. This is not an exhaustive list of all works on this topic, and we encourage you to seek out additional resources as needed. This citation guide is in MLA format, and it is only a citation model if you are also writing in MLA style.

Hofmann, Angelika. *Scientific Writing and Communication*. Oxford University Press, 2017.

Irish, Robert. *Writing in Engineering.* Oxford University Press, 2015.

Knisely, Charles and Knisely, Karin. *Engineering Communication.* Cengage Learning, 2015.

Paradis, James and Zimmerman, Muriel. *MIT Guide to Science and Engineering Communication.* The MIT Press, 2002.

Penrose, Ann and Katz, Steven. *Writing in the Sciences.* Pearson Education, 2004.

*Want to talk to someone about the information in this handout or how to apply it to your own writing? Make an appointment to come into the HWC and talk with a professional or peer tutor: writing.caltech.edu/tutoring*