

Nuts and Bolts of Writing a Grant Application (Or Everything You Wish Your Mom Taught You About Grant Writing)

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Grant Funding Series

1. I Have To Write A Grant: How Do I Get Started?

- a. What will money buy you (time, salary support, personnel, research costs)?
- b. How do you come up with a fundable idea (who to talk with and how to strategize at the white board)?
 - i. Should be exciting to work on
 - ii. Addresses a gap in the field
 - iii. Be doable
 - iv. Taps into your strengths (e.g. access to a unique patient cohort, biological samples, biorepository, unique dataset, etc)
- c. How do you create the needed research team and take advantage of collaborators?
- d. Should you contact the Program Officer?

2. The Nuts and Bolts of Writing a Grant Application (Or Everything You Wish Your Mom Taught You About Grant Writing)

- a. Individual sections beginning with a Specific Aims page
- b. Biosketch
- c. Letters of Support
- d. Budget

3. Writing Your Career Development Plan for a Grant: the new requirements

- a. What is now required
- b. Structure of Candidate Information and Career Development Plan
 - i. Specifics of mentoring
 - ii. Specific coursework

4. Alternative Sources of Grant Funding and Not Putting All Your Eggs in the NIH Basket

- a. Foundations, Industry (Pharma/Biotech), Philanthropy
- b. How do you dovetail applying to different agencies without overlap of the grant idea?

Objectives



What are the critical sections of a grant application?

How do I write a compelling Specific Aims Page

What elements lead to a fundable score?

Sources of my materials:

- My own experiences
- Grant Writers Handbook: <https://www.grantcentral.com/workbooks/national-institutes-of-health/>
- Peg Atkisson PhD: <https://www.atkissontraininggroup.com/handbook>

How to Get Started

- Create a checklist with at least 3-4 month lead time (up to 1 yr is great)
- Map out your overall hypothesis and how you will test it
 - Vet with your team/collaborators or anyone who can provide input
- What collaborators or consultants do you need?
- Do you need IRB or IACUC approvals?
- Inform your grant research administrator of your intent
 - If you need subawards/consortium agreements, that takes >3 months
- Once you have a draft specific aims page, discuss with your program officer
 - e.g. approval of budget over \$500K/yr or if this is the right institute

9-point rating scale

Score	Descriptor	Additional Guidance on Strengths/Weaknesses
1	Exceptional	Exceptionally strong with essentially no weaknesses
2	Outstanding	Extremely strong with negligible weaknesses
3	Excellent	Very strong with only some minor weaknesses
4	Very Good	Strong but with numerous minor weaknesses
5	Good	Strong but with at least one moderate weakness
6	Satisfactory	Some strengths but also some moderate weaknesses
7	Fair	Some strengths but with at least one major weakness
8	Marginal	A few strengths and a few major weaknesses
9	Poor	Very few strengths and numerous major weaknesses

Minor Weakness: An easily addressable weakness that does not substantially lessen impact
Moderate Weakness: A weakness that lessens impact
Major Weakness: A weakness that severely limits impact

Scores:

- Significance
- Innovation
- Approach
- Investigator(s)
- Environment

The Research Plan - Overview

- Specific Aims page (one page)
- Research Strategy/Plan (12 pages)
 - **Significance** (half to one page, 3 paragraphs)
 - Paragraph 1:
 - Is there a strong scientific premise for the project (criteria used by reviewers)
 - Paragraph 2: **Rigor of Prior Research** (*use this title*)
 - State what is strong vs not and for the latter, how you will address in your project
 - Paragraph 3: How will the proposed research advance our understanding
 - Paragraph 4: **Expected Impacts of the Proposed Research** (*use this title*)
 - Needs to be strong!
 - **Innovation** (half to one page)
 - What is innovative?
 - Can be a new analytic approach (metabolomics/proteomics/lipidomics, new model for testing (animal, organoids, cell lines, new/unique cohort of subjects). Doesn't have to be earth shattering but innovative approach to testing your hypothesis that others haven't done in the way you are proposing
 - As you write your approach, keep a bulleted list of what is innovative in your proposal
 - Approach (research strategy and plan, timelines)

Cite Key Papers

NIH Review Criteria

- Significance:
 - Does the project address an important problem or a critical barrier to progress in the field?
 - If the aims of the project are achieved, how will scientific knowledge, technical capability, and/or clinical practice be improved? How will successful completion of the aims change the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field?
- Innovation:
 - Does the application challenge and seek to shift current research or clinical practice paradigms by utilizing novel theoretical concepts, approaches or methodologies, instrumentation, or interventions?
 - Are the concepts, approaches or methodologies, instrumentation, or interventions novel to one field of research or novel in a broad sense?
 - Is a refinement, improvement, or new application of theoretical concepts, approaches or methodologies, instrumentation, or interventions proposed?
- Approach:
 - Are the overall strategy, methodology, and analyses well-reasoned and appropriate to accomplish the specific aims of the project? Are potential problems, alternative strategies, and benchmarks for success presented? If the project is in the early stages of development, will the strategy establish feasibility and will particularly risky aspects be managed?

Specific Aims Page:

no different than going to a symphony

“Your goal as a grant writer is to pull your readers forward through your text in a way that entices them to want to find out more about the project” Morgan Giddings

Specific Aims Page:

Everyone Reads It with Variable Backgrounds

Simple Linear Logic



- Paragraph 1 (3 sentences)
 - What's the problem and why should we care? (not a chapter review!)
 - Describe the magnitude of the problem ([Significance](#))
- Paragraph 2
 - What is your solution ([Innovation](#))
 - Start with your overarching purpose (long term goal)
 - Background knowledge and barriers/issues
 - Your preliminary data which this application is based upon
- Paragraph 3 (or can be part of Paragraph 2)
 - Your strategic approach and hypothesis to be tested ([Approach](#))
 - Why you are uniquely poised to solve this problem
- Specific Aims ([Approach](#))
- Impact of the work ([Mission of the Funding Source](#))

Common Errors On Your Aims Page That Take Down Your Score

- Very dense Aims page
- Unfocused application that is a fishing expedition
 - Cataloguing of many assays
- No clear statement of the problem
- No hypothesis or shaky hypothesis, or multiple hypotheses
- Concern the investigator lacks expertise and hasn't published in this area
- Too many aims and especially subaims
- “in this pilot aim”

Font Size Requirements at NIH

- 11-point font size or larger
 - No more than 15 characters per linear inch (including spaces)
 - No more than 6 lines per vertical inch
- Recommend but do not require the following font types:
 - Arial, Georgia, Helvetica, and Palatino Linotype
- Figures: not less than 8 font (readable on a 100% computer screen)
- Figure legends: not less than 9 font
- Each figure should make one clear point with the legend being a sentence that summarizes the take home point

The Research Strategy and Plan (Approach)

- Overall rationale and preliminary data informing the strategic approach
- Then list each aim
 - 1.1 Background and Preliminary Data (have subheadings).
 - Figures and tables need to be readable without magnification!
 - 1.2 Experimental Approach
 - Subheadings for each of the groups of studies such as animal model or patient cohort, analytic studies, etc
 - No need for very specific details such as sample volumes or how you will run gels
 - RIGOR:
 - » Need to emphasize how the experimental design and methods will achieve robust and unbiased results
 - » Also need to detail control of biologic variables such as sex, age, weight, underlying health conditions will be factored into design and analyses
 - » Authentication of Biological or Chemical Reagents not commercially available (Attachment)
 - 1.3 Power, Sample Size, and Statistical Analysis
 - Critical to include even for basic science studies
 - 1.4 Anticipated Results (or Expected Outcomes) and Interpretation
 - 1.5 Potential Problems and Alternative Strategies
- At the end, have an Overall Timeline (can be a table) and then Future Directions
- Literature cited

Title, Abstract, Project Narrative

- Title: for NIH is 200 characters including spaces
 - Incorporates your key words
 - Is very readable
- Abstract (for NIH is 30 lines)
 - Should highlight significance, innovation, key methods, and expected outcomes and impact
- Project Narrative (for NIH is 3 sentences)
 - Appears in the NIH RePORTER
 - Start with the following sentence: “This is relevant to public health because...”

Authentication (Rigor & Reproducibility)

Key Biological and/or Chemical Resources

- Include as an attachment labeled: Other Research Plan (not in the Approach)
- Include, but not limited to
 - Cell lines, organoids, specialty chemicals, antibodies and other biologics.
 - Key biological and/or chemical resources may or may not be generated with NIH funds and may differ from laboratory to laboratory or over time;
- May have qualities and/or qualifications that could influence the research data
- Are integral to the proposed research.
- Each investigator will have to determine which resources used in their research fit these criteria and are therefore key to the proposed research.

Human Subjects/Vertebrate Animals

- Read carefully the directions and put in specifics:
- Human Subject Protection
 - Justification for involvement of human subjects and the proposed protections from research risk with listing of the following five review criteria:
 - 1) risk to subjects, 2) adequacy of protection against risks, 3) potential benefits to the subjects and others, 4) importance of the knowledge to be gained, and 5) data and safety monitoring for clinical trials.
 - Also detail: Inclusion of Women, Minorities, and Children
- Vertebrate Animals
 - Justification for involvement of animals with listing of the following five points:
 - 1) proposed use of the animals, and species, strains, ages, sex, and numbers to be used; 2) justifications for the use of animals and for the appropriateness of the species and numbers proposed; 3) adequacy of veterinary care; 4) procedures for limiting discomfort, distress, pain and injury to that which is unavoidable in the conduct of scientifically sound research including the use of analgesic, anesthetic, and tranquilizing drugs and/or comfortable restraining devices; and 5) methods of euthanasia and reason for selection if not consistent with the AVMA Guidelines on Euthanasia.
- IACUC or IRB approval is ideal
- Cannot be any ethical issues even remotely

Facilities and Other Resources

- Lab
- Office
- Other support facilities
- The environment around your lab or research area (e.g. other researchers and departmental resources)

Equipment

- Equipment in the PIs lab
- Shared Equipment
- Core Equipment
- Other Resources
 - Institutional Support
 - Intellectual environment – specific conferences, etc
 - Core Facilities
 - Additional support services

Biosketch (5 pages max)

- Part A – Personal Statement
 - All about you
 - Background including what you have done
 - What are your overall goals
 - Any confounding issues (e.g. COVID, pregnancy, illnesses, moving)
 - Ongoing and recently completed projects that I would like to highlight – list funding sources and titles
 - Then list up to 4 citations that reflect your overall accomplishments
- Part B: Positions, Scientific Appointments, and Honors
- Part C: Contributions to Science - list up to 5 areas (numbers) with up to 4 specific publications (letters) and include PMCID: PMC.
 - Must be in press or accepted
 - Can cite preprints from BioRxiv or other preprint servers but check instructions
- Conclude with:
 - Complete List of Published Works in MyBibliography:
<http://www.ncbi.nlm.nih.gov/myncbi/collections/bibliography/47854752/?reload=publicURL>

Collaborations

- Fills in the gaps you don't have (and aren't expected to have)
 - Cohorts to enroll or provide samples
 - Analyses, informatics
 - Biostatistics (critical especially for all clinical research studies)
- We know the PI frequently writes all the letters of collaboration
 - Provide a draft to your collaborator that they modify and put on their stationary
Can only be one page for many grant applications
- A publication with your collaborator shows it is a real collaboration
- Part A in their Biosketch should describe what they will provide
- Decide on their calendar months.
 - Can be effort without salary support
 - May only need their support in specific years (e.g. after enrollment completed)

Budget

- Should be thoughtful and reflect the true costs, including their increase over the time frame of the grant application
 - Personnel (calendar months), Travel (may only allow domestic travel)
 - Equipment, supplies, animals, housing costs, cells, patient costs, publication costs
- Need to justify each major budget item
- Modular vs Detailed budget
 - Modular is up to \$250K per year in direct costs. Streamlines the budget details and only need to justify personnel
 - Detailed is over \$250K – need to list all budget items including consortium/sub awards (need extra time to get these set up and approved at each site prior to admission).
 - For budgets of \$500K, need preapproval. Would check with your Program Officer to be sure for all budgets over \$250K.

What Should You Do Before You Submit?

- Write your Summary Statement
- Try to present your work in 2 minutes
- Is it easy to read and can get your take home message?
 - Show it to people outside your field. If not revise it.
- What is the weakness in your proposal
 - Once identified, either fix it or do a mea culpa and describe how you will take it into account (pitfalls and alternative strategies)
 - If you don't address it, reviewers will likely focus on it!
- This is why you need months to prepare a strong submission