

Development of a Successful Research Proposal: From Concept to Funding



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Successful Grant Proposal - I

- Address important questions in basic and/or applied sciences
- Experimental plan will answer many of those questions in an efficient and convincing manner
- The investigator is familiar with and fully comprehend the contemporary research literature in the field
- The investigator and/or their collaborators have optimal experience to execute the relevant techniques proposed in the experimental plan (*you are the best person in the world to do this project!*)

Successful Grant Proposal - II

- The investigator has access to all the required equipment, reagents, and personnel essential to execute the proposed experiments
- The investigator has demonstrated his/her ability to analyze and publish data in a thoughtful, honest, and timely manner
- The investigator has provided convincing evidence that the proposed experiments shall be accomplished within the specified time and budget

Successful Grant Proposal - III

- After compilation of preliminary data, allow a minimum of **three** months to write a grant proposal (*specially if this is your first*)
- Select an extramural source of funding that would be optimal for solicitation
 - Field of research
 - Criterion for funding (new versus established investigators; a particular area of funding, etc.)
 - Advice from “funded” and “experienced” colleagues (with study section and/or grant/manuscript review experience)
- Read the published instructions carefully and follow them to the letter

Successful Grant Proposal - IV

- Write the entire proposal and set aside for a few days
- Re-read it in its entirety; you'll be surprised how many errors are uncovered
- Once you are marginally satisfied with your proposal, forward the “**best**” draft (*not your first*) to the following individuals for a critical review (*allow at least two weeks for this phase*):
 - Nonspecialist in the field; preferably a funded investigator with study section experience. This person must review all sections of the proposal **except** Preliminary Data and Experimental Methods for clarity and logic. Remember....at least one of the two-three reviewers of the proposal will most likely be non-specialist
 - Specialist in the field; should review “Preliminary Data and Experimental Methods” sections

Successful Grant Proposal - V

- If such help for pre-submission review is not available than solicit the same from third party, professional, fee-for-service
- Bottom line:
 - Consider writing grant proposal as a “*rigorous intellectual challenge*”
 - Ensure that the proposal is precise, lucid, and logical
 - Do not submit a proposal that has not been critiqued prior to its submission...such an action is generally considered as a “professional suicide”
 - Be receptive and responsive to proposed changes...if you are seeking critique be prepared for one
 - If the pre-submission review is not challenging...in all likelihood you have selected “inappropriate” reviewers

Successful Grant Proposal - VI

- If the proposal is send to NIH, NSF, NEH, NASA, DOD or any other Federal or State agency, make an attempt to identify the study section most suitable to review your application
- Accomplish this objective early in the process thus allowing you to evaluate the expertise and the experience of members of the study sections. For most agencies, a list of study section membership is available on-line
- When mailing your application to the funding agency, append a cover letter suggesting the study section identified and provide a brief rationale for your request...this is encouraged

Grant Layout - Generic

- ABSTRACT
- SPECIFIC AIMS
- BACKGROUND AND SIGNIFICANCE
- PRELIMINARY RESULTS
- EXPERIMENTAL DESIGNS AND METHODS
- BUDGET AND BUDGET JUSTIFICATIONS

ABSTRACT AND SPECIFIC AIMS - I

- The two MOST IMPORTANT sections of your proposal...they set the tone for reviewer's enthusiasm (or lack thereof) for your proposal
- The content of these two sections must be written so as to avoid repetition
- First sections you write...because they serve as the blue print for your proposal
- The last sections you revise...because it is imperative that they agree with the content of the Experimental Design and Methods section

ABSTRACT AND SPECIFIC AIMS - II

- Most good research is **HYPOTHESIS-DRIVEN**
- What is a hypothesis?
 - A supposition or conjecture put forth to account for known facts; esp. in the sciences, a provisional supposition from which to draw conclusions that shall be in accordance with known facts, and which serves as a starting-point for further investigation by which it may be proved or disproved and the true theory arrived at (*Oxford English Dictionary, Second Edition, 1989*)
- What is NOT a hypothesis?
 - Your predictions of how the results of one particular experiment will turn out

ABSTRACT AND SPECIFIC AIMS - III

- Design experiments that test your hypothesis from various view points
- NEVER assume your hypothesis is true...this error has doomed many applications
- Remember...you can never prove or disprove a hypothesis; you can only CONFIRM or REFUTE it
- Convince the reviewer that:
 - You are truly planning to test your hypothesis...not simply collecting data to confirm your favorite hypothesis
 - You will reject the proposed hypothesis if the experimental data so indicates

ABSTRACT AND SPECIFIC AIMS - IV

FIVE CARDINAL RULES TO FOLLOW WHEN WRITING THESE SECTIONS:

- Introduce the reviewer to the problem you are addressing...with minimal background to orient the non-specialist
- Describe your hypothesis and its corollaries that are being tested by specific set of proposed experiments
- Provide an outline of the main techniques you will be using
- Define overall experimental plan
 - Indicate how the results of the various proposed experiments will mesh to form a cohesive explanation that will advance significantly this field of research
- Include **ONLY** experiments that you or your collaborator(s) have expertise to perform

BACKGROUND AND SIGNIFICANCE - I

- Remain focused on the issues your experiments will address...be thoughtful and brief
- If your project concerns basic research, do not make an attempt to overtly emphasize its clinical significance and vice versa
- Convince the reviewer that you have good command of current research literature in this field, and that you can be objective and thoughtful in your analysis of data
- Don't dodge controversies...make certain you are diplomatic and non-dogmatic in your evaluation of opposing hypothesis/points of view

BACKGROUND AND SIGNIFICANCE - II

- Identify **relevant** publications to which you or your laboratory have contributed
- Cite the relevant work of as many different laboratories as possible, consistent with clarity and space limitations
- At the end of each topic, highlight for clarity how your proposed experiments and their outcome will help further our understanding of important and as yet ill-defined issues in this field

PRELIMINARY RESULTS

- This sections helps demonstrate to the reviewer that:
 - You have experience (*ideally published*) with most of the experimental techniques proposed in the application
 - You can design logical, well-controlled experiments
 - You can present your results in a clear and thoughtful manner
- Show data that demonstrates your ability to conduct the most difficult of the proposed experiment
- Presents your results (even if preliminary) in a concise, objective, and professional manner...do not overstate your claims or ignore different possible interpretations
- Show only data relevant to the proposed experiment...explicitly highlight the relevance

EXPERIMENTAL DESIGN AND METHODS - I

- Divide this section into:
 - **Experimental Strategy**
 - Provide clear narrative of the rationale and design of each proposed experiment and the interpretations of possible experimental outcome
 - **Material and Methods**
 - Provide important specifics about the “practical” steps required for the successful execution of the proposed experiments
- This is the section that the specialist review the MOST
- Indicate how you will design and execute the proposed experiments addressing each of your Specific Aims
- Propose only experiments that are directly relevant to testing of your hypothesis and that you or your collaborator(s) have expertise to execute successfully

EXPERIMENTAL DESIGN AND METHODS - II

- Include appropriate controls in the design of your experiments...do not propose more than your laboratory can reasonably do in the requested time and allotted budget
- Provide a clear and logical process for analyzing and interpreting the data
- Provide convincing explanation to the reviewer of how the outcome of proposed experiments will be utilized to revise the proposed experimental plan

EXPERIMENTAL DESIGN AND METHODS - III

- Indicate important specifics:
 - Exposure times, concentration of reagents used and why, source of reagents, statistical methodology, etc.
- Minimize the use of abbreviations...when used, explain
- Pay particular attention to details of techniques that you have least published experience...check with an expert for validation
- Incorporate a time-table within the body of the experimental methods for completion of proposed studies

BUDGET AND BUDGET JUSTIFICATION - I

- Pay particular attention to this section...for funding agencies do
- Consider yourself as a creditor and the funding agency as a bank...you can never go wrong
- With modular NIH budget, you do not have to justify as long as you propose to spend <\$250K
- For NIH proposals of >\$250K and for application to other agencies, **JUSTIFY EVERYTHING**...do not assume

BUDGET AND BUDGET JUSTIFICATION - II

- Request the appropriate amount of money required to execute the proposed experiments...do not overtly inflate your budget...the reviewers are likely to trim it by more than the amount by which it was inflated
- Make certain that your application is internally consistent...your budgets must agree with the proposed experiments
- Consultants expenses are hard to get...request should therefore be minimal and well justified

BUDGET AND BUDGET JUSTIFICATION - III

- Justify the effort you propose to spend on the project...PI effort of <20% raises concern about your commitment to the study
- Justify why you need each requested piece of equipment
- Study sections are inclined to award equipment support to new investigators who are in the process of establishing their labs...they may not be equally sympathetic to established investigators

BUDGET AND BUDGET JUSTIFICATION - IV

- Ask for only one person to travel to national/international meeting/year to present the data
- Forget about requesting funds for renovation expenses...I have never seen them being awarded
- Remember...your competence to conduct the proposed experiments will be questioned if you are unable to formulate a well justified budget

WHAT DO YOU DO IN THE INTERVAL BETWEEN THE SUBMISSION AND THE REVIEW?

- Identify weak links in your application
- Continue to gather additional data to bolster these weak links
- Publish...publish...publish!!!
- Submit supplemental information (summarized in few [\sim 2-3] pages) to the study section or funding agency prior to mailing of your proposal to the reviewers

What Do You Do Now?

- Breathe and relax...there is nothing more you can do
- Hope and pray for the best...and if you do not get funded...that is not the end of the world (or is it!)
- Try and try again...success comes to those who DO NOT GIVE UP