Thoughts on Grant Writing

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Note that there are different and apparently equally successful writing styles

This summarizes some lessons learned by Boris while writing and reviewing grants

(Grant) writing can be 'learned'!

Two important questions to ask yourself before you start writing

What do I want to achieve? The clearer you understand where you want to go the easier it will be. When in doubt during the writing process, measure against the goal.

Who am I writing for? This is important to find the appropriate level of formality, technical detail, or the argument to focus most heavily on.

What do you want to achieve in a grant proposal?

You want it funded! After reading your grant the reviewer has to be your advocate and lobby for your grant, for him/her to do so you need the reviewer:

To understand your research plan to the fullest extent possible -- with little effort on his/her side

To understand that this is an exciting new idea that pushes interesting science and has important implications beyond (medical, economic, you name it)

To understand that you happen to be exactly the right person to take this on

Science and grants are 'work in progress'

Once the arguments and experiments are all clear and straight in your head – the grant is typically easy to write

So why then is serious writing so hard and exhausting for most of us?

Because the arguments and ideas often are not yet all clear when you sit down to write!

Science and grants are 'work in progress'

Try to perceive grant writing more as a continuous creative process rather than banning something on paper that already exists

Stay flexible and willing to change!

If you can't write about it convincingly, you should consider that it might not be convincing.

Science and grants are 'work in progress'

Approach writing like you would approach an experiment -- dissect it

Isolate the argument that is causing you trouble

What could be changed to overcome this (drop or add experiments, reframe the question, read up on additional background or different approaches)?

You have it right when it looks so doable that you wonder why nobody has done that already

How do I get going?

Write a rough one page draft (specific aims)

Be your own reviewer: is this really convincing, do we care, can it be done? Be critical and honest with yourself.

Get some peer input early (if you wait to the end you have little time for major adjustments).

Draft your Background, then detail your experiments.

Write your summary last. Make sure it's not "listy" or too technical, but confers the broad strokes of your research vision, your enthusiasm for these ideas, and their timeliness

The grant format

Technical administrative stuff (money, regulations)

Abstract

Biographical sketches, Resources, Equipment

Specific Aims

Research Strategy: Significance, Innovation & Approach

Literature, Letters of support ...

Specific Aims

Start with a paragraph that highlights the significance of your research and provide critical background and preliminary data to ensure reviewers understand your aims. This should be heavy on rationale & vision.

Specific aims should be specific -- but not technical.

When you construct your specific aim try the **"biology first"** rule: put the biological question and/or hypothesis first, then provide the technical solution.

The "Biology First" rule, let's look at an example

Aim 1: Flow-cytometric analyses of lymphocytes from mice infected with T. cruzi.

Aim 1: Identify lymphocytes critical for the control of T. cruzi infection.

Aim 1: Which subgroup of lymphocytes is critical for the control of T. cruzi infection?

See the difference? Systematically check your draft with this rule in mind!

The anatomy of a Specific Aim -- or any bit of scientific writing

Title (which includes a question or hypothesis). Rationale. Question. Hypothesis. Approach (keep it simple yet convincing). Expectation towards outcome/ What next?

The anatomy of a Specific Aim -- or any bit of scientific writing

Aim 1: Does the "Biology First" rule improve the funding success of NIH grant proposals? Attaining funding is a critical hurdle in the career of new investigators. However, firm rules on how to write successful proposals are currently missing. Based on the results of a preliminary survey of 55 new investigators we hypothesize that putting biology first is an important part of a winning strategy. To test this idea we will experimentally evaluate the response of reviewers to paired specific aims which do or do not use the Biology First rule. As controls ... (don not go overboard on the detail) We expect that this part of our study will provide a robust and statistically significant evaluation of the Biology First rule. A validated "Biology First" rule will provide an important tool fostering the careers of numerous young scientists.

Research Strategy:

Significance, Innovation, Approach

Why do we care?

What do we know?

What will be new?

What have I already done in preliminary work?

What will I really do here?

Research Strategy: Significance

Should I suggest my research will be interesting science, or should I rather stress its applied medical importance?

Your research will be interesting and important!

The reviewer will look for "impact" -- what will be different in the world after you did the work that you propose in your grant

Both basic and applied contributions could have tremendous impact -- or not.

Research Strategy: Significance

Do not just fill pages with facts and citations around your topic!

Use this section to build momentum towards your new project.

You can finish some of your sections by pointing out that "in Aim 3 of this proposal we will elucidate the mechanism of this phenomenon by …"

Be sure to cite mostly primary research. Limit reviews and stay away from web sites. Don't cite papers you have not read -- fact check!

A lot rides on your reputation, do not tarnish it.

Research Strategy: Innovation

Highlight the new and exciting aspects of your proposal:

A truly innovative hypothesis that will provide a solution to a long puzzling problem

New developments have generated a timely need for your work (an outbreak, emergence of drug resistance)

New resources are available and you will make clever use of them (genome sequences, a strain collection, a new ...)

You are developing an innovative approach or novel technology to study your question

Feature your own recent discovery or technical breakthrough prominently and show its promise

Preliminary data

This can be published work (in a condensed version) but often features data that are not yet publicly available and comes in different flavors:

Data that motivated you to initiate a research project and frame the backdrop for the rationale or question

Data that support your hypothesis

Data that suggest that your approaches are feasible

Data that exemplify the type of studies you plan to do

Preliminary data

Do not hide good stuff, but also do not distract the reviewer with a flood of data

Make clear arguments with your data

Do not present data that you do not believe yourself!

Preliminary data

Preliminary data are an important part of your reputation with the reviewer. They also give the reviewer the opportunity to evaluate your judgment

Don't be timid but make clear that you understand all the caveats and alternative explanations

If you plainly don't know something say so and point out how the proposed work will clarify the issue

Approach

This is the place to flesh out your specific aims with real experiments, follow a more detailed version of the specific aim anatomy.

Write this like a paper, you just don't have the data yet.

Do not provide a boring technical run down of your experiments!

Make sure the rationale for each experiment is clear, remember to lead with the problem, then provide the solution.

Approach

Convince the reviewer that the methods are appropriate, that the experiments have a high likelihood of success and that you are well versed in these approaches

Make sure that your experiments test the hypothesis and that you provide a specific expectation towards the outcome

Discuss different possible outcomes and make clear how such results would impact your hypothesis and how that will change your plans.

What if your approach fails? Provide a discussion of potential pitfalls or problems and offer solutions or back ups to these problems

How to handle technical detail?

(especially in the experimental plan)

Be mindful of the diversity of reviewers

Some will hear about your area for the first time, while others are the world's expert on the subject

Your writing has to please & convince both camps

Don't loose the generalist, and let enough technical sparkle shine through to convince the specialist that you know your stuff

How can you have it all in one document?

How to handle technical detail?

(especially in the experimental plan)

Try to write in layers like an onion

Start the Aim with a discussion of the rationale/question

Summarize your technical solution in a way everybody on the panel should understand (e.g. we will test importance of genes by making mutants)

Then dive into the nuts & bolts (how exactly will you make the mutants)

Wrap up with a discussion of what you will have learned that again is conceptual and not technical

The Finish line

Make sure you have sufficient time to finish

Proposals riddled with typos and errors may appear sloppy and annoy reviewers

Make sure your references are complete and correct

Pre-clear internal administrative hurdles and deadlines

Have a copy editor!

How can I practice?

The next seminar you go -- draft a quick AIM for the next thing the speaker should do to advance his or her project.

You can do the same thing for a paper you read (you may get the material straight from the discussion) -- frame the next experiments as a specific Aim.

You can do this with a fellow student in your program -- when you are done you exchange the Aims and review them ...

Some web-resources:

http://www.hfsp.org/how/ArtOfGrants.htm

http://www.niaid.nih.gov/researchfunding/grant/Pages/newpiportal.aspx

http://www.niaid.nih.gov/ncn/grants/default.htm

The grant writing & reviewing process

Investigators submit proposals to an agency or foundation (usually following a prescribed format)

Agency assembles a group of peers to review proposals

Reviewers read grants and produce a written review

Reviewers meet and discuss proposals and establish a merit ranking

Agency makes funding decision

Applicant receives decision along with critiques and may prepare an amended application.

Reviewing grants

Boris encourages you to watch the video below to get a better feel for what awaits your grant in review.

This is a video production from the NIH that shows a typical review panel: http://cms.csr.nih.gov/ResourcesforApplicants/InsidetheNIHGrantReviewProcessVideo.htm

Categories addressed in NIH reviews

SIGNIFCANCE: Is this important?

APPROACH: Is the approach sound?

INNOVATION: What's new here?

INVESTIGATOR: Is the PI and his/her team qualified to pursue this project?

ENVIRONMENT: How good is the environment for this type of work?

OVERALL EVALUATION: A paragraph that brings it all together that is focused on overall impact