Writing a Successful Grant Proposal

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First things first:

the IDEA

How do we get a good idea?

There are no short-cuts!

- get smart: read, read, read.
- now: think, think, think
- finally: wait

From the Medici Effect (F. Johasson, 2004): Innovative ideas often arise at the intersection of paradigms not formerly connected.

So: learn many different things. Read on widely varied topics. Look for unexpected connections.

Finally, trust your intuition. Allow ideas to percolate up. Sometimes that takes time.

Get (and stay) organized!

Use endnote (or another reference manager) as more than a bibliography-maker: it is also a database of your references.

File papers (now pdfs) by the ref # that endnote assigns them.
(*idea from Loyal Tillotson*)

DO NOT make separate libraries for each doc you write. Make one and only one. Let it grow. You'll be glad in the long run.

Take notes as you read!
- by topic
- by reference #

Use pdfs to your advantage:
- keep them all in one folder
- link in endnote
- sort aliases by topic, grant, paper...
- don't print: read, highlight, annotate digitally

What is a proposal?

- fundamentally, request for $
- an argument/chain of reasoning, in which you identify an important problem and describe how you will solve it.

What isn't a proposal?

- an opportunity to show how smart you are
- a review of every bit of info on your topic
- a defense

The proposal is not about you!! It is about

SCIENCE

What are the critical features of a proposal?

SIGNIFICANCE: is it important?

NOVELTY: is it original?

FEASIBILITY: can it be done?
can it be done BY YOU???

Components of a grant are like a paper:

** Specific Aims = Abstract

Background and Signficance = Introduction

Preliminary Data = Results

Research Design = Methods

Specific Aims: the Formula

BIG ISSUE is a serious problem for __*(humans)*__.

However, this *essential thing* remains unknown.

The *essential thing* (ET) is likely to be a critical aspect of the problem because __*(FACT 1)*_ *(ref).*

Fact 1 is connected to fact 2 *(ref).* Etc.

Fact X (or: Taken together, this) leads to hypothesis/model: __*ET plays particular role*___.

Several predictions arise from this hypothesis/model, including 1, 2, 3.

The overall goal of this proposal is to determine __*BIG THING; whether ET is central/causal in BIG ISSUE; whether this model is correct*__ by completing the following specific aims:

1. To determine whether (prediction 1), WHAT will be measured/ evaluated/characterised/tested using HOW.
Iff needed, more details: outcome 1 would indicate yes, whereas outcome 2 would indicate no (only if not obvious or redundant). OR This technical approach is particularly useful because.... (only if technique is novel or unusual).

2. etc.

3. etc.

BIG ISSUE is a serious problem for __*(humans)*__.

However, this *essential thing* remains unknown. **Significance**

The *essential thing* (ET) is likely to be a critical aspect of the problem because

__*(FACT 1)*_ *(ref).* Fact 1 is connected to fact 2 *(ref).* Etc. **Argument**

Fact X (or: Taken together, this) leads to hypothesis/model:
__*ET plays particular role*___. **Hypothesis**

Several predictions arise from this hypothesis/model, including 1, 2, 3. **Predictions**

1. To determine whether (prediction 1) (WHY),

WHAT will be measured/ evaluated/characterised/tested using HOW.

Specific Aims: common mistakes

- Lack of clarity
- Lack of hypothesis
- Too much info
- Unclear or vague aims-

they're called 'specific' for a reason.

The SAs are the most important part of the grant!!
They MUST be superior.
Not just good, not even great,
but SUPERIOR.

Good aims:

- Independent/Nonhierarchical
- Feasible
- Informative regardless of outcome.

Background and Significance

Significance

Argument

Hypothesis

Predictions

Outline for body of B&S: each of these at least one paragraph.

Aim 1: why, what, how

Aim 2: why, what, how

Aim 3: why, what, how

B&S final paragraphs: briefly outline with a focus on big picture value of the proposed experiments

Very last paragraph: connect back to significance: “completion of this study will lead to impt insights into BIG ISSUE”

B&S: Common mistakes:

1. Too much information: stay focused

2. Too little information: be convincing

3. A failure to state the obvious, or to make overt connections.

do NOT expect your reader to do the thinking! Spell it out.

4. Lack of organization, meandering text

write in outline form. Use topic sentences wisely to inform your reader what each paragraph is about.

no mysteries, no punchlines, no surprises.

use figures sparingly and wisely to illustrate key points.

5. Ignoring part of the story: do not leave out evidence that goes against your hypothesis/model: address it.

6. Lack of objectivity!! Smacks of bias: the kiss of death

Preliminary Data: Show us what you've got

1. WHY is each piece of data important?

2. WHAT is the **conclusion** of each figure?
This should be the figure **title**.

3. HOW does each each piece of data
- support the model?
- test a prediction?
- connect to the other data?
- reveal a Q?

Figures

1. Explain/illustrate your model system/organism
2. Explain/illustrate background info
3. Display prelim data
4. Support your argument
5. Schematize your model.

Each figure will not do all of these things, but should do at least one of them.

Figures that do none of these things should be excluded!!

Legends

Write legends as briefly as possible without compromising completeness. Less is more here. If it's short, it will be read. If it's really long, who wants to read it?

BUT, it must be complete. Describe all the panels, state doses, treatments, techniques, etc.

Sometimes if you need to say a lot about a figure, it's better to put that info directly into the text and make the legend only a title. E.g., a model.

Figures

- Figures need to be big enough to easily read
- Make figure as attractive as possible: colors, symmetry
- Not too busy!!!

- Figure legends should stand alone, & be succinct but complete
- Conclusion of figure = figure title

- State conclusions: avoid descriptive titles

"Nodal antisense expression blocks axis specification" YES

"Morphology of Nodal-antisense expressing embryos" NO

If not yours (e.g. in B&S), cite source.

In Prelim Data, ALL the figures need to be YOURS, or at least your lab's.

Common mistakes:

- irrrelevant figures, gratuitous figures
- too small, too many, too detailed, too busy
- poor legends

Research Design

For each aim (or each expt within each aim):

Rationale: WHY are you proposing these experiments? How will the outcomes inform the issue? Why are you choosing these particular techniques?

Approach: HOW will you go about this? {How does technique work? ONLY if technique is new, unusual, or atypical for your field (i.e., your readers are likely to be unfamiliar with it).} What are your controls?

here you need specifics: how many timepoints, what are they, and why. What doses? How many measurements? Statistical approaches? Etc. This is *not* about technical details (like spin conditions, PCR cycles, etc), but about the *design* of the experiments.

Outcomes and interpretations:

1. How can the expt turn out? Obviously in reality, experiments generally could have an infinite (or at least vast) number of outcomes. So think in terms of outcome classes/categories, e.g. less than 1, equal to 1, or greater than 1.

2. For each outcome, how would you interpret that? How does that impact the hypothesis? What would be the next step? What would be an alternative approach or a corroborative measure?

Significance

Argument

Hypothesis

Predictions

} Rationale (per aim)

Aim 1: why, what, how

Aim 2: why, what, how

Aim 3: why, what, how

} Approach
Outcomes and Intepretations

Research Design: common mistakes

- failing to explicitly mention controls. Do NOT assume controls are implicit.

- failing to give detailed interpretation. Do NOT assume interpretation is intuitively clear- even if it is to you. SPELL IT OUT.

- failing to give hypothesis & rationale for experiment. Same- be explicit.

- experimental details- too much or too little. Do not drown the reader in a sea of unneeded details. But enough must be present to convince the reader of the proposal's feasibility IN YOUR HANDS.

- failure to discuss pitfalls and/or to discuss potential results that do not support your hypothesis.

- overinterpretation of potential results.

please avoid the use of the word "prove", as in: this particular outcome would prove that X has this relationship to Y. We never prove anything. Keep your interpretations cautious.

corroborate outcomes. Demonstrate how thorough and careful you are. But don't err at the other extreme either- you don't need to corroborate your finding in 16 different ways. One or two ought to be enough.

Weaknesses

Your proposal will have weaknesses. Maybe it's hierarchical, for example. Maybe there are weaknesses are in the argument....etc.

What's important is to address them, rather than attempt to sweep them under the rug. The reviewers will see them either way...

Writing

What are the hallmarks of good writing?

**1. Easy to follow and understand. Clear. Unambiguous. Precise!!

2. Pleasing to the internal ear. Not too many repeated words or phrases.

3. Interesting. The reader wants to keep reading it. Non-boring (as far as possible).

4. Illustrated with compelling, clear images. (Or at least, convincing, clear images)

5. As short as possible without sacrificing clarity.

6. Convincing and confident. but not arrogant, pompous, or over-confident. An understated tone is best, but strongly so.

Writing: common mistakes

- *sacrificing clarity for brevity*
- *writing from the wrong perspective.*

- inclusion of unnecessary words and phrases.
- too many arbitrary adjectives/adverbs
- jumble of formal and informal.
- redundant
- imprecise

- poor organization and construction.
- inconsistent styling
- overly long

- too much mincing and caution.
- overstatement of conclusions
- implying but not stating conclusions

Writing: how to write well

1. Make a detailed outline. Know what refs you'll cite in advance, know what the job of each paragraph is. What figures you'll need, where they'll go...Plan, plan, plan!!

2. Barf and buff

3. Buff and buff. Cut cut cut. Incubate and repeat.

4. Get someone else to read it. Preferably someone NOT in your lab.

5. Now get someone else to read it. Someone mean/honest and smart

6. Finally, read it out loud. Best way to final proof read.