Proposal Writing

The Business of Science

Science is a Business?

- Hopefully not for you, not right now, but…..
- ALL research endeavors in our field whether in academia, industry, or wherever, require resources
  - Equipment
  - Animals
  - Drugs
  - Cell lines
  - People (even students)

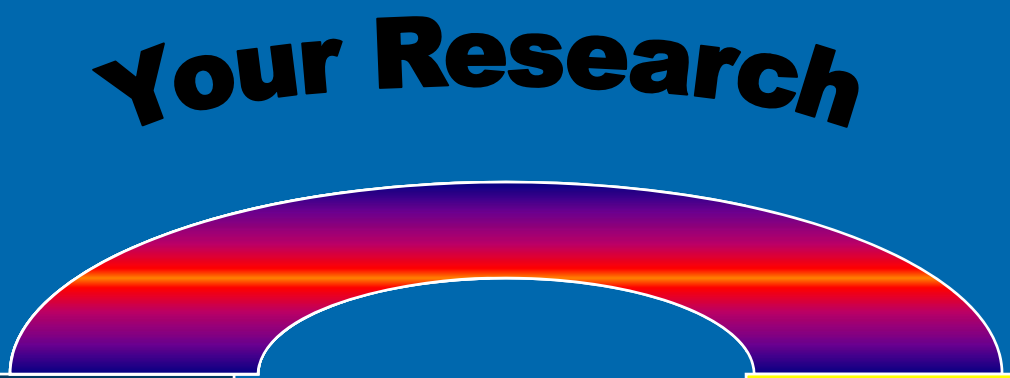
Science is a Business?

- To get these resources, someone usually has to ***convince*** someone to give them these resources
  - (or the money to get these resources).
- Usually through some sort of a proposal

Proposal Writing

- A Persuasive Writing exercise
  - To make a CONVINCING argument for your ideas
  - NOT Science Fiction
    - (but pretty close….because it doesn't exist yet)
  - To tell the story of your ideas
  - (IT HAS TO START WITH A GOOD IDEA!!)

Proposal Writing



What is already known (Past and Present)

Knowledge Gap

What we WANT to know (Future)

Proposal Writing

- Start with your good idea(s)
- Now get other people excited about it.
- COMMUNICATE the ideas…through the proposal.
  - Don’t be surprised if in the process of writing down your ideas, you revise – and hopefully improve – these ideas

Proposal Writing

- What does a Proposal Consist of?
- Aren’t there lots of different formats?

Proposal Writing

- BMP Faculty has decided to adopt the NIH R01 format
- The R01 format has 4 sections:
  - Specific Aims
  - Background and Significance
  - Preliminary Data
  - Research Design and Methods

Specific Aims – 1 page!

- What does the research AIM to do?
- Be Specific; But be concise and to the point.
  - Cure Cancer – Good aim, but not specific
  - Cure Colon Cancer – getting warmer, but not there yet…
- Some reviewers think this is the most important part of the proposal
  - If the reviewer is not excited after reading the specific aims, the methods will not excite them either
  - Stimulate the interest of the reader so that they are excited to read on.
  - You want them to think:
    - How *will* they do that?
    - I would like to see what they plan to do to solve that problem….

Specific Aims – 1 page!

- Begin aims with a brief (2-3 sentence) summary of the problem/issue addressed in your research.
  - Refer to the significance of the proposed research here.
  - (NO references here….that will come later).

- Think of your aims as experiments
  - Possibly to test your overall hypothesis(es)
  - Discussed further

Specific Aims

- Since your aims are a "to do" list, present them in active language:
  - "to quantify", "to determine", etc.
  - Avoid vague language that leaves your reviewer uncertain as to exactly what it is you are proposing to do, for example, do not write "to study"

Specific Aims

- A frequent question is how many specific aims should a proposal include?
- Typically three or four
- Don’t give a laundry list of aims
  - May appear too ambitious

Specific Aims

- Aims should have a common theme – testing a hypothesis
- A hypothesis is an educated *prediction* about the outcome of your study.
  - You may not be right, but you should be able to *determine* if you are right!
  - Hypotheses must be testable.
- The point of your research proposal should be to develop experiments designed to test your hypothesis.
- If you are doing development work (developing a new method or a new device), how can you tell if it is “better” than the existing methods or devices? How would you test that?

Specific Aims

- The Overall goal (aka a long-term goal)
  - The final component to include in specific aims.
  - Provides a sense of not only what you wish to accomplish in the proposed research, but how this piece fits into your future plans.

Specific Aims

- Finally, your aims should be the first piece you write.
  - Remember – 1 page!!!
- In fact, it can be very helpful to draft the aims, then circulate them for review.
- Important, because your aims are the basis for your proposal
- So
  - Begin work on your proposal early and draft the aims first
  - Circulate them (fellow students, etc.)
  - Incorporate feedback
  - Then draft the proposal.

Specific Aims

- Examples…..

Bkgd and Significance (2-3 pages)

- The first purpose of this section is to demonstrate your understanding of your field by ***critically*** analyzing the pertinent work of other investigators leading up to your proposed work.

- "Critical" means that you are able to appreciate the contributions of others and identify:
  - What has been done
  - What has not yet been done (Every work has limitations).
  - Identifying the "gaps in our understanding".

- Next, describe how your work will:
  - Contribute to the “knowledge gap”.
  - Overcome the limitations of current work

Bkgd and Significance (2-3 pages)

- Finally, make certain that the significance of your proposed work is clearly shown.
- This is not the same as showing that the health issue/disease to which your research relates is significant.
- NOT the significance of the Disease itself.
- Rather, describe the ***impact*** of your research on the disease or health issue in question
  - Convince your reviewers that your proposed research addresses an important clearly defined question pertaining to health/mechanisms of disease.

Preliminary Studies

- In “Written Qualifying Exams”,
  - Not be expected to have any prelim data, so you can skip this section.
- In “First Oral Exam”,
  - You will be expected to have some prelim data for this section.

Preliminary Studies

- This section establishes your ability to carry out the proposed studies.
- Demonstrate what studies you have completed and submitted for publication (if any);
  - or at least presented at conferences.
- Studies presented should be RELEVANT to the research question being investigated
  - (Not what research you did for In-N-Out while an undergrad).
- Remember – you are building a case here, telling your story…

Research Design and Methods

- Longest section of the research plan;
  - approximately half of the pages are devoted to it.
  - Important section
- Purpose is to explain how you will carry out your specific aims.
- So, organize this section by aim;
  - Begin with a brief description of your overall approach,
  - Then describe the experiments to be conducted to achieve each aim in consecutive fashion.
- BTW – not just Methods, but “Research Design and Methods”

Research Design and Methods

- The design is the way in which you conceptualize your experiments
  - Provides Rationale for your approach
  - You could have designed your project several different ways – why this one?
  - Show thoughtfulness to readers
- Methods are a detailed discussion of exactly what you will do to carry them out.
  - Make sure you provide your reviewers with sufficient detail to evaluate your work.
  - DO NOT ASSUME reviewers already know all of the details.
  - DO ASSUME they are experts in the field
  - DO ***NOT*** ASSUME they are experts in ***YOUR*** portion of our field.

Research Design and Methods

- As you describe your experiments….Provide the rationale for each one.
- You could just describe what you are doing, but BETTER to describe WHY you are doing it.
- Help the reader by using sentences such as:
  - To accurately model the source, we….
  - To assess beam collimation, we will first determine..
  - To *further* extend the verification of the source models, we propose a set of measurements and simulations of surface dose using actual patient data.

Research Design and Methods

- Include a data analysis section.
  - Do NOT simply list names of stat tests performed
  - Describe what types of data will be recorded,
  - How they will be analyzed
  - What they will mean in terms of your hypotheses.

Research Design and Methods

- Another very important part is to provide a discussion of the potential limitations and how you plan to deal with them
- Discuss technical problems that may arise and what alternate plans you may implement
  - what if something doesn't work?
  - If specific aim 2 is highly dependent on developments in specific aim 1, then what happens if things in SA-1 don't work out?

Research Design and Methods

- End this section with a timeline
  - Could be mostly graphical
  - Some are more narrative
- Communicate:
  - That your experiments are doable in the proposed time
  - That you have a plan for carrying them out.
- Please NOTE:
  - Timeline is not a contract
  - NOT a commitment
  - Timelines do slip…..
  - Provide your BEST, but reasonable, estimate to carry out each experiment

Good example

Research Design and Methods

- Include a data analysis section.
  - Do NOT simply list names of stat tests performed
  - Describe what types of data will be recorded,
  - How they will be analyzed
  - What they will mean in terms of your hypotheses.

Grant Writing References

- http://www.niaid.nih.gov/ncn/grants/write/index.htm
- http://www.ninds.nih.gov/funding/write_grant_doc.htm
- http://grants.nih.gov/grants/grant_tips.htm
- http://www.niddk.nih.gov/fund/grants_process/grantwriting.htm