Writing Successful Research Grant Proposals

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Handouts

1. Slide copies
2. Guidelines for Writing and Reviewing a Research Grant Proposal
3. Make Every Word Count Twice
Learning Objectives

1. Discuss extended benefits of writing a proposal
2. Plan in advance
3. List three strategic goals of grant proposal
4. Explain how Specific Aims can sell proposal
5. Describe strategies and content for each section of Research Plan
Why Write a Research Grant Proposal?

1. Establish your commitment to this project (rather than 10 others)
2. Clarify and focus research question, strategy, design, and methods
3. Identify needs
4. Develop team
5. Communicate plans with colleagues
6. Negotiate over resources, using grant for leverage
7. Obtain money, promotions, prestige

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Planning the Proposal
Think Before You Begin to Write
Conceptual Planning: What is the science behind the project?

• What is the main question to address? The objective? Public health significance?
  How does the project fit into your field?

• What specific hypotheses will you test?
  What experiments will give you answers most productively?

• Do you have enough preliminary data to show feasibility and experience?
Strategic Planning: Who will fund the project?

- Who has funded projects on your topic?
- What does your targeted funding agency invest in?
- Who should you contact?
- Do the agency’s goals overlap with yours? Can you recast your project to match their interests?
- What kind of reviewer will read your proposal?

Tailor proposal to audience’s interests and level of expertise

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Logistical Planning: How will you carry out the project?

1. What essential resources are needed?
   - Time, staff, equipment, space
   - Research materials (patients, samples, cell lines, reagents)
   - Required approvals (IRB, animal care)
   - Collaborators and consultants

2. What resources must grant provide? What already exists?

3. How will you coordinate your aims, timeline and budget?
**Sample of Project Timeline***

<table>
<thead>
<tr>
<th>Specific Aims</th>
<th>Yr 1</th>
<th>Yr 2</th>
<th>Yr 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim 1a: Identify subjects</td>
<td>xx</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aim 1b: Chart review</td>
<td></td>
<td>xxxx</td>
<td></td>
</tr>
<tr>
<td>Aim 1c: Data analysis, ms prep</td>
<td>xxxx</td>
<td></td>
<td>xxxxx</td>
</tr>
<tr>
<td>Aim 2a: Recruit subjects</td>
<td>xxx</td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>Aim 2b: Conduct intervention</td>
<td>xx</td>
<td>xxxx</td>
<td></td>
</tr>
<tr>
<td>Aim 2c: Follow-up and assess outcomes</td>
<td></td>
<td>xxx</td>
<td>xxx</td>
</tr>
<tr>
<td>Aim 2d: Data analysis</td>
<td></td>
<td>xx</td>
<td>xxxx</td>
</tr>
<tr>
<td>Aim 2e: Interpretation, ms preparation</td>
<td></td>
<td></td>
<td>xxxxx</td>
</tr>
<tr>
<td>X = 2 months</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Grant planning timeline

6 mo  Read literature & craft good question
      Write specific aims & get input from others
      Plan & negotiate, organize & assign tasks

3 mo  Draft Significance, Innovation
      Draft Approach (initiate subcontracts)

6 wk   Get critical reviews from others

3 wk   Edit & perfect (receive subcontracts)

2 wk   Send to Grants Office

0 wk   Submit

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The more you plan in advance of writing:

- the less time you will waste on crafting language for the wastebasket
- the more clear and focused final proposal will be
Writing a Grant Proposal

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Why Use the NIH Grant Model?

- The NIH format is well planned and widely used outside the NIH
- Everything we discuss will be relevant to other research grant formats—just find a place for it!

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Primary Goals of a Grant Proposal

1. Persuade reviewer of importance of work
2. Persuade reviewer of your ability to do the work
3. Describe study clearly and completely

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Most Common Reasons for NIH Grant Disapproval

1. Lack of new or original ideas (1,2)
2. Absence of acceptable scientific rationale (1,2)
3. Unfocused, superficial or overly ambitious research plan (2,3)
4. Uncritical approach (2)
5. Lack of knowledge of published, relevant work (2)
6. Lack of preliminary data or experience in essential methodology (2,3)
7. Uncertainty concerning future directions (2,3)
8. Lack of sufficient experimental detail (2,3)

Goals: 1. Importance  2. Ability to do it  3. Clear description

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NIH Review Criteria*

1. **Significance**: importance of problem, new knowledge to be gained, impact on scientific field
2. **Innovation**: novel concepts, approaches, methods, technologies, or interventions
3. **Approach**: conceptual/clinical framework, design, feasibility/risk management, methods, analytic plan, alternatives, human subjects protection and inclusion
4. **Investigators**: investigator or team training, experience, past productivity
5. **Environment**: supportive scientific environment, unique subject populations, collaborative arrangements, institutional support

* Relevant to all research grants

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Specific Aims: Strategies

- Be brief
- Introduce essential elements of proposal
- Outline proposed work
- Discuss impact of study
Specific Aims: Content

1. State purpose of proposed work
2. State general question or hypothesis
3. Explain context from which study emerged:
   - previous work or pilot data
   - special clinical interests
   - problem in field
4. Identify model, system or sample
5. List proposed experiments and hypotheses
6. Describe long term impact of your research program

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Research Strategy

- Significance
- Innovation
- Approach
  - Study Design
  - Preliminary Studies
  - Methods
- Brief finale
Significance: Strategy

- Identify critical problem or barrier to progress in field
- Show how proposed work will fill this gap in knowledge
- Review literature selectively and critically
- Emphasize impact: how the field will be changed

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Significance: Content and Organization

1. Broad view: State why work is important in broad context of public health or science

2. Optional: Outline conceptual model for work (e.g., diagram of hypothetical causes and effects)

3. Review status of knowledge in field to justify your Specific Aims*

4. Restate importance of work: how will the field change if aims are achieved?

* Spotlight opportunity
Proposed Metabolic Syndrome Factors in the Life Course from Obesity to Cardiovascular Disease

Potential Precursors:
- **Adiponectin**
- Other inflammatory cytokines

**Abdominal Obesity**
- Dyslipidemia
- Elevated BP
- Abnormal glucose-insulin metabolism
- Pro-inflammatory factors
- Pro-thrombotic factors

**Tobacco use/exposure**

Childhood → Adolescence → Adulthood

Genetics, Perinatal, **Puberty**, Diet, Physical Activity

Diabetes → Cardiovascular Disease

Bold = factors included in this study

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Innovation: Strategy and Content

- How project will challenge or shift current research/clinical practice
- Use of new concepts, approaches, or methods
- Innovation is closely related to Significance—may be a bulleted summary
Approach: Strategy

- Describe rationale for:
  - research design
  - choice of methods (downplay experimental details)
  - analytic approach

- Be sure to address feasibility

- Discuss potential problems and alternative approaches

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Approach: Overall organization

- Research Design
- Preliminary Studies*
- Methods: format choices
  - Wholly integrated
  - Divided by aim
  - Combination
- Analysis of Results

*Often integrated with Methods

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Research Design: Strategy

- Outline of study
- Rationale for selecting this design, including compromises
- Discuss implications of design limitations
- Offer alternative approaches

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Research Design: Content

- **Overview of study**
  - Design graphic
  - List of key measures (usually outcomes)
  - Timeline of experiments

- **Rationale for design (not significance)**
  - Stick to pragmatic issues
  - Defend all critical choices in designing the study; explain compromises
  - Explain any contingencies in aims and design limitations
Preliminary Studies: Strategy

- Provide provocative data to support your choice of specific aims
- Demonstrate ability to do the proposed work:
  - critical thinking skills
  - technical expertise
- Demonstrate feasibility of study
Preliminary Studies: Content

1. Summarize and critically interpret preliminary studies, showing how they support proposed work*

2. Document availability of and experience with required population, models or reagents

3. Document experience with proposed methods

* Spotlight opportunity

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Methods: Strategy

- Emphasize strategy > details, e.g., expected outcomes, data interpretation, pitfalls and contingencies
- Devote space only to methods that are crucial to the study and unpublished
- **ESSENTIAL:** Offer alternative approaches to challenging experiments

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Methods: Content

- Organize around Aims, and format for quick reference
- Consider diagram of research model *
- Use table to cite previously published methods
- Refer to letters of support for more details
- Describe alternative approaches *

* Spotlight opportunity
Aim 1: 
non-activated eosinophil

GM-CSF
Asthma

Increased response to chemotactic and degranulating stimuli

Aim 2: 
primed (pre-activated) eosinophil

protein (L-plastin) phosphorylation & expression

Formation of GMR-PKC-L-plastin signaling complexes

Aim 3: 

protein phosphorylation

Signaling downstream of L-plastin
Leading to integrin upregulation and eosinophil priming

p-2-19 peptide

Used with permission of Konrad Padzrak, MD, PhD, Assistant Professor of Biochemistry & Molecular Biology, NHLBI Proteomics Center, UTMB

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Analysis of Results

• Describe statistical approach and methods (minimize jargon; give enough detail to be understood by typical reviewer)

• Discuss predicted outcomes and their relationship to hypotheses

• Provide alternative approaches to analysis and interpretation*

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A BRIEF Finale: 3-4 sentences

• Summarize project limitations and solutions
• Remind about project importance and strengths
• End with strong statement about project impact

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Make Every Word Count Twice:

How to squeeze your proposal into half the space
Make every word count twice: Fly high

- Work to achieve the 30,000 ft perspective
  - Practice your “Big Picture” skills
  - Develop your elevator speech
  - Tell it to your Mom

- Craft a 30,000 ft and a 5,000 ft summary statement and refer to these as you write

- Practice focus on design > methods, approach > techniques

- Create the context (big picture) carefully, then add details only as needed (e.g. use examples to clarify and energize)
Make every word count twice: Fight for brevity

- Practice the rules of brevity:
  - Build sentences around the best subject
  - Choose strong verbs for compact power of expression
  - Use active voice to simplify sentences
  - Avoid abstractions and long-winded, abstract sentences
  - Avoid empty phrases ("due to the fact that...")
  - Use controlled parallel constructions to build embedded lists

GO TO: http://www.academicpeds.org/espauthoring/page_01.htm

- Make your pictures worth 1000 words: use figures and tables to reduce need for narrative
- **Use smart formatting** simplify navigation and emphasize critical phrases
- **When you repeat for emphasis, use new words to give a new spin or added meaning**

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The value of writing grant proposals

- Obviously we need the money to do our work
- However, writing a proposal will improve your thinking about your research, with or without funding
- Learn to do it well, and your science will improve