

# Specific Aims 101

MCRC-CTRIS

Multidisciplinary Clinical Research Center –  
Clinical and Translational Research Incubator Seminar

Leena Sharma MD

September 19, 2017

## References

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- Ruben Alvarez EdD, Stuart Moss PhD. NICHD/NIH 2017 Regional Seminar: Grant Writing for Success, Overview
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# Introduction

- Funding = greatest hurdle to pursuit of academic career in rheumatology (*Davidson 2015*)
- Yet, must be pursued, again and again to build research career
- Grant writing is an acquired skill
  - Nothing intuitive about how to write a grant to convince study section members why your project is among the most worthy (*Nigrovic 2017*)
- If we hope to develop successful physician-scientists, teaching grant writing must be a key mission
- In this room, wide knowledge gap....

# Introduction

- “*Be sure to have someone read/critique your grant!*”
- This often fails (*Nigrovic 2017*)
  - Providing feedback on a whole grant is hard
    - Really reading a proposal takes much time and is cognitively strenuous, especially if outside of reader’s direct area of expertise
    - This is a lot to ask of someone, particularly repeatedly
  - Critical problems – the kind that will sink a proposal – are often foundational
  - “*The understandable wish to show a valued colleague only one’s best work tends to result in the appearance in our e-mail inboxes of proposals that are obsessively polished yet still hopelessly flawed, way too close to deadline for the real problems to be addressed.....a very unfortunate waste of everyone’s precious time*” (*Nigrovic 2017*)
    - Grant writer
    - Friendly colleague
    - Study section member

# Introduction – General steps to developing an NIH proposal

- Understand how NIH works
- Find a funding opportunity
  - Timing is key for
    - career development grants, i.e., targeted to specific phases in academic ladder
    - proposals that address time-sensitive needs or opportunities
- Plan your application
- Write your application



## Elements of Score

- Overall Impact
  - Significance
  - Approach
  - Innovation
  - Investigator
  - Environment

## Individual Score Criterion – Significance

- Does the project address an important problem or a critical barrier to progress in the field?
- Is there a strong scientific premise for the study?
  - Your published research or preliminary data
  - Literature as a whole in specific area of grant, context for your work
- If the aims of the project are achieved, how will scientific knowledge and/or clinical practice be advanced?
- Value-added?

## Individual Score Criterion – Approach

- Are the overall strategy, methodology, and analysis well-reasoned and appropriate to accomplish the specific goals?
- Have the investigators presented strategies to ensure a robust and unbiased approach for the work?
- Have the investigators presented adequate plans to address relevant biological variables for studies in vertebrate animals or human subjects, e.g., sex?
- Are potential problems and alternative strategies presented?



## RIGOR – Assessed within Approach

- Now formalized in the stated review criteria
- Rigor – strict application of the scientific method to ensure robust and unbiased experimental design, methodology, analysis, interpretation and reporting of results
- Provide confidence that the research can be reproduced
- Consideration of confounding variables
- Consideration of sex as a biological variable
- Assessed as part of the Approach criterion

## Individual Score Criterion – Innovation

- Can refer to either ideas or methodology
  - Does the application challenge and seek to shift current research or clinical paradigms?
  - Are the approaches novel to a field of research?
- Innovation generally has the least negative impact on overall impact score, however, a truly innovative approach can have a strong positive impact

## Individual Score Criterion – Investigator

- Do the investigators have the training and skills necessary to perform the proposed studies?
- Does the investigative team bring complementary and integrated expertise to the project?
- Use your biosketch to describe your major contributions to the field and explain any mitigating circumstances that might have impeded recent progress
- Reviewers will use biosketches, budget justification, and research plan

## Individual Score Criterion – Environment

- Does scientific environment in which the work will be done contribute to the probability of success?
- Does proposed work take advantage of unique features of the scientific environment or employ useful collaborative arrangements?

## Significance and Approach are most important

- Low significance, no matter what other scores are, nearly impossible to fix
- High significance but weak approach may be fixable, but depends on nature of weaknesses in approach

## Overall Impact Score

- Reviewer's overall determination about likelihood that proposed study will have a strong and sustained impact on the field(s)
- Not mathematically related to individual criterion scores
- Should applicants do it?
  - Are Aims based on strong premise? (Significance section)
  - Innovation
  - Not an incremental advance
- Can applicants do it?
  - Considering approach, investigators, and environment, are goals likely to be met?
  - Approach sound and rigorous?
  - Have potential confounding variables been considered?

## Grant Development – What do reviewers look for?

- Clean, well-written, easy to follow
- Significance and impact
- Strong premise leading to exciting ideas
- Clarity of rationale
- Clarity of goals
- Realistic aims and timelines
- Rigorous approaches
- Noted limitations
- How potential problems will be handled

## Grant Development – Don'ts

- Don't develop grant that will be characterized as only descriptive
- Don't develop application that will be characterized as only making incremental advance
- Don't develop overly ambitious application
- Don't make Aims dependent on each other
- Don't assume reviewers know as much about subject as you
- Don't assume reviewers will care as much about subject as you
- Don't write diffuse, unfocused proposal
- Don't wait too long to start working on grant, i.e., to prevent front-to-back quality decline
- Don't assume everything in the proposed study will work perfectly



Tasks (with mentor)	Before 12m	Months before deadline											
		12	11	10	9	8	7	6	5	4	3	2	1
Preliminary data – depending on type of grant (funding mechanism)	X												
Assess yourself, resources, ongoing funded work (NIH RePORTER)	X												
Brainstorm, identify ideas, call NIH staff	X												
Know funding mechanism & score-affecting items for that mechanism, inside and out	X												
Monitor for changes to NIH applications	X	X	X	X	X	X	X	X	X	X	X	X	X
Set up study team	X												
Set up review committee, prepare timeline	X												
Write hypotheses, get feedback, REFINE	X												
Write aims, get feedback, REFINE	X	X	X										
Develop budget		X	X										
Develop outline of application structure			X										
Write 1 <sup>st</sup> major draft				X	X								
Get feedback on 1 <sup>st</sup> major draft						X							
Revise to create 2 <sup>nd</sup> major draft							X	X					
Get feedback on 2 <sup>nd</sup> major draft									X				
Revise to create “final” version										X	X		
Proofread “final” version												X	
Meet institutional deadlines												X	
Submit													X

## Why this focus on the Aims Page? *(Nigrovic 2017)*

- Specific Aims page is the most important page of the grant
  - 1-page crystallization of the project, the problem, hypotheses, supporting literature and preliminary data, proposed path forward
  - “Elevator talk” that persuades reviewer that the proposed work is important, approach is rigorous, and investigator qualified
- Aims page makes powerful first impression, an impression embedded in reviewer’s mind for rest of review
  - Well-informed, thoughtful, and bold without hyperbole?
  - Attention to detail?
  - Sophisticated and nuanced for expert reviewer AND accessible to non-expert reviewer
- Requires meticulous attention from grant writer and all who want the grant writer to succeed

## What goes on the Aims page?

- Clearly identify the harm, need, or problem the research will address
- Good Aims page hits all the review criteria: significance, investigator, innovation, approach, and environment
  - What will be done
  - Why
  - Why this investigator
  - Why here
  - Why now
- Convey overall impact of your work, what the findings will mean

## Write the Aims Page first! *(Nigrovic 2017)*

- Flaws that sink grants are typically fundamental – these are usually evident in the Aims page
  - If Aims Page fails to make a compelling case, then writing the rest of the grant is likely a waste of time
- Then, when you write the grant, the “storyline” is clear.
- A grant idea may return to the drawing board after aims page review, saving time, effort, and sadness, while those that “pass muster” are more likely to become competitive proposals
- In the process of writing the Aims page, you are designing the study, identifying most rigorous approaches, solving the problems that will emerge – all of this should be thought through before you start writing rest of grant

## Sequence to Follow in Writing Aims Page

- First, write and refine hypotheses – essential first step before designing any study
- Second, write Aims corresponding with each hypothesis
  - Convey specific, rigorous approaches
- Third, write top and bottom of Aims page
  - identify the problem
  - convey premise – alluding to literature and to preliminary data
  - convey significance
  - convey impact of proposed project
- Show mentors Aims page before writing any other section
- Go through several iterations of the Aims before submitting to ARC for review – after ARC review, revise again
- Keep a ‘notes’ document for other sections to keep track of ideas and content as they emerge – will aid subsequent writing

## Writing Hypotheses

- Begins with an observation of a situation or a problem
- Hypothesis = clear, formal, free-standing statement that is a supposition or a proposed solution or prediction in the context of a specific scenario
- Required components
  - “experimental” variables, independent and dependent
  - must be measurable or testable in some way
  - include who and when
- Well-written hypothesis will help you to develop a strong grant
- Poorly written hypothesis will infect every step you take in grant development

## Examples

- “Cultural” differences between fields and study sections – get help from experts!
- In the examples, the reviewer could write all or almost all of their review based on what is presented in this page – make the reviewer’s life easy!
- But, must give them a page that shines

## Aims Page Grantsmanship

- A well-written Aims page gives reviewer much of their review
  - Help the primary reviewer to create summary, one that will stun the panel with its excellence
- Grant gathers most of its positive points by end of Aims page – after that, you just lose as reviewers look for hidden flaws
- Get to the point – reviewer should know what grant is about within first few sentences...don't bury the lead
- Have empathy for your reviewer
  - Make it inviting – spaces between paragraphs, no tiny figures
  - Avoid multiple acronyms
  - Avoid bulky sentences
  - Avoid long paragraphs
  - Use crisp, plain, straightforward language
  - State hypotheses explicitly – do not require a reviewer to deduce them



## Aims Review Committee

- Goal – NIH funding success among applicants at all stages, particularly new and early-stage investigators
- Introduction and Orientation
  - This talk
  - Nigrovic 2017
- Participants
  - PI (and applicant’s team members invited by PI)
  - Core committee group based on NIH R01 funding track record (LS, HP, RMP, CS, and, as needed, JC)
  - Invited senior investigators with track record in NIH funding relevant to applicant’s field
  - Mix of experts – some closely related, some less so (similar to study section)

## Aims Review Committee – Before the Meeting

- $\geq$  9 months before application deadline
- Applicant submits request to ARC Chair/Assistant using our 1-page form
  - proposal title
  - PI, co-Is, consultants
  - brief 1-2 paragraph synopsis
  - senior investigators with NIH track record to potentially invite
  - whom in your team you would like to invite
- Session scheduled
- 1 week before session, applicant submits draft of Aims page for circulation to committee

## Aims Review Committee – the Meeting

- One by one, members respond to written page, identifying strengths and weaknesses
- Comments focus on science and presentation
- Applicant may respond but should mostly listen (like fly on wall at study section)
- Discuss each aims page for at least 20 minutes
- After each member comments, have a discussion period

## Aims Review Committee – After the Meeting

- Send applicant a summary of comments/concerns + deadline for revised Aims page
  - To be prepared by designated expert matched to application, a primary reviewer of sorts
- Repeat process until acceptable draft achieved

# Aims Review Committee – Communal Aspect

*(Nigrovic 2017)*

- Discussion amplifies and refines specific concerns, helping weaknesses to emerge more clearly into view
- Process mimics what happens in real grant review panel
  - Where a loose thread noted by one reviewer may be seized upon by another, and then another
  - Sometimes the opposite happens – ARC members can reassure a grant writer that a concern voiced by one member is not widely shared
- Here, unlike real study section, effort to offer solutions
- Modest time contribution – 15-30 minutes to read Aims and then 60 minutes for meeting – much greater impact of time investment vs. reading and critiquing a full and flawed draft
- This is when go/no-go decision should happen, not after a full proposal draft

# What the Aims page cannot do

*(Nigrovic 2017)*

- Cannot make up for a weak project – although Aims page development, if done the right way, can help to identify a weak project
- An inexperienced investigator
- Overwhelming competition
- Microscopic payline

*To handle these: resilience, persistence, hard work, and a little luck – we should model these for mentees too*

# Acknowledgement



**U.S. Department of Health and Human Services**



**National Institutes of Health**



**National Institute of Arthritis and Musculoskeletal and Skin Diseases**

# Thank You