Writing Specific Aims – overview & template

Overview

- Your Aims page is the most difficult section to write because it is a summary of your application
- All, or nearly all, reviewers will read your Aims page
- Broadly speaking, your Aims page describes how your proposed work will fill an gap in knowledge that is preventing the field from moving forward; it summarizes the general research steps by which you will test your hypotheses; and it gives the reviewer confidence that *you* are the team that can accomplish the project
- Some say you engage or lose the reviewer here
- Some say that experienced reviewers can assign an 85% accurate score just by reading this page
- Think of each Aim as one paper, or a significant part of a paper
- Each Aim should take about the same amount of time/effort and be of about equal importance
- NIH sample applications: https://www.niaid.nih.gov/grants-contracts/sample-applications

What NIH expects (words excerpted from various NIH websites)
- Focus on an important problem, unresolved issue, barrier to advancing the field, or gap in knowledge
- The answers you seek must be important to the field
- Aims are narrowly focused, concrete objectives you can achieve during the grant
- Explicitly state your hypothesis and why testing it is important
- The experiments you propose must be able to test your hypothesis
- Include your expected outcomes
- Highlight the significance of your research to science and health
- The individual Aims are not inter-dependent but are supportive of each other. They flow logically, but can't be absolutely dependent on a particular outcome of another Aim

Think about *who* you are writing for
- Aims page is targeted at primary and secondary reviewers, other study group members, program staff and advisory board and council members. So -- write Aims for less of an expert compared to the rest of the application (~level of '*Scientific American*')
- The rosters for NIH standing study sections and scientific review groups are public—find out which scientists are on your review panel and what their expertise is
    - https://public.csr.nih.gov/StudySections/StandingStudySections
    - https://public.era.nih.gov/pubroster/
- Don't assume your reviewer is an expert in your area; write with both experts and smart scientists in mind
- Put yourself in your reviewers' shoes – what will they find important, interesting, boring?
- Reviewers should be able to get a good sense of review criteria (Significance, Innovation, Approach, Investigator, Environment) from the Aims page. Make sure you touch on all five.

Don't propose too much
- Aims are your short-term objectives /project milestones — not your long-term research goals
- Propose 2-4 Aims total—depends on type of grant and length of grant period
- Ask yourself how much work can you realistically accomplish in the time you are requesting

Writing style
- Short, declarative sentences
- Bullets are fine, as appropriate
- Be careful with opening verbs that could be interpreted as too descriptive (see below)

Good Aims can be tested against the "SMARTL" criteria:

- **Specific** – includes elements such as why, who, what, how, where, when, which, how much
- **Measurable** – can be tested empirically; will know if Aim is accomplished/hypothesis is tested
- **Attainable**–you and colleagues have the expertise and resources; you can accomplish the objectives with the resources and time you are requesting
- **Relevant** – the field cares about it, it is right for you as an investigator
- **Time-bound** – do-able within grant period
- **Learning** – the field learns something interesting and not trivial; you learn something that contributes to your research development

Verbs for Specific Aims—a list to get you started

Probably good verbs	Probably good verbs	May be considered too descriptive
Apply	Discover	Correlate
Ascertain	Establish	Describe
Characterize	Evaluate	Develop
Compare	Identify	Examine
Construct	Improve	Measure
Define / further define	Investigate	Understand
Delineate	Prepare	
Design	Quantify	
Detect	Test	
Determine	Use	

Specific Aims Template

Step-by-step instructions to help you generate a good first draft

This Template can be used with the Planning Matrix.

Much of the wording here came from an Aims Template created by Dr. Morgan Giddings; I have expanded and changed as made sense to me. A virtually identical organization was suggested by the Grant Application Writers Workbook and by Drs. Mardie Thompson and Erica Whitney (please see Sources section at the end of this document). Thanks to all!

The Specific Aims page typically comprises 3 sections: (1) Preamble, (2) Specific Aims, (3) Payoff paragraph.

1.   Preamble

There are 2 different ways to draft the Preamble.

Option 1 for drafting the Preamble

1. BIG PICTURE – state the SHARED, CENTRAL CHALLENGE of your field that lots of people are interested in solving. If possible, do this in a way that will draw the reader's interest rather than restating well-known statistics about a disease. (1-2 sentences)
2. KNOWNS – elaborate on what is known about the central challenge and what has been going on to solve it. This will set the scene for presenting the gap, what you are going to do, and your theory behind the gap. You might include why the challenge is still there. (2-3 sentences)
3. The GAP in knowledge (aka PROBLEM, BARRIER or BOTTLENECK) – Name a general gap in your field that is slowing or stopping progress towards achieving the big picture named in the first item. *THIS IS VERY IMPORTANT*: You must know which single gap your proposed work will fill; to fill this gap is WHY you are proposing this work. Note that the GAP is seldom the lack of the thing you are proposing; the GAP is a need in the field and what you are proposing is your idea about how to meet that need. Try starting with *'however'* or *'unfortunately'*. (1-2 sentences)
4. ELABORATION on the gap – for example, tell what you and others have tried or are trying and maybe why those approaches have not worked; tell how the gap prevents the field from advancing; and/or describe why the gap still exists. (1-2 sentences)
5. THEORY and UNIQUENESS that leads to your proposed solution – tell what unique thing(s) *you* know or have (e.g. your preliminary findings or newly published data) and how that unique thing forms the basis for your thinking about how things work or what you are now able to do/find out to fill the gap. (1-2 sentences)
6. HYPOTHESIS (if working in hypothesis-driven area) – State the overall hypothesis that your Aims will test. The hypothesis has to flow from your unique thing and/or your qualifications: "*These combined data and work by others in the field support our hypothesis that xxx …*" "*We formulated this hypothesis based on…*" (1-2 sentences)
7. YOUR APPROACH as the solution – State how you propose to fill the gap; state this in general terms. (1-2 sentences)
8. Your TEAM – If it is not already clear, tell why you are the right people to conduct the proposed research. (1-2 sentences)

A practical note: Remember, this outline is designed to get you to you a good/comprehensive first draft that tells a story about how the work you propose will fill an important need in the field; you almost certainly will need to redraft this Preamble.

A word on framing: You probably will re-write the Preamble if you submit the same project idea to a different funding agency and/or study section. This is because you must frame the Preamble using information and gaps in knowledge that your reviewers and funder find important. Learn about the types of grants your funder/study section typically supports; try to put yourself in your reviewers' shoes and imagine how they will respond to what you are writing.

Option 2 for drafting the Preamble

1 – Write a paragraph that includes the first part of the preamble:
1. BIG PICTURE / CENTRAL CHALLENGE
2. KNOWNS
3. GAP in knowledge
4. ELABORATION on the gap

2 – Write a 2nd paragraph that shows how the proposed work aligns with your experience, long term goals and hypotheses about how things work in the field:
1. Your LONG TERM goal – state the continuum of your research / where you want to be several grant applications in the future. It should connect to the general gap you identified above. (1 sentence)
2. Object of THIS specific proposal – state your goal for this proposal. Tell how accomplishing this project will move you close to meeting your long term goal (might include what you have done already). Tell how what you plan to do fills the gap you identified above. (1-2 sentences)
3. Overall/central HYPOTHESIS – state what it is. Tell why you formed that hypothesis (e.g. your prelim findings suggested it, literature suggested it) if not already clear. (1-2 sentences)
4. RATIONALE for conducting study – tell how your research will advance the field / why it is important to do this particular research / how your work will allow you or the field to move to the next step. (1 sentence)
5. Your TEAM – See notes above. (1-2 sentences)

> Sample wording for the 2nd paragraph:
>
> *Our long-term goal is to understand ____. The specific objective of this proposal is to ____. The central hypothesis is that ____. We formulated this hypothesis, in part, based on our preliminary data which shows that _____. Our track record in __ includes ___. The rationale for the proposed research is that once it is known how ____ then ___.*

2.   Specific Aims (most people have 2 – 4 of these)

Each Specific Aim is an objective/goal. Each Aim tests a specific facet of your central hypothesis: commonly, you will have one hypothesis for each Specific Aim.

For each Aim you will include some or all of these:

- Statement of the Aim, in bold or underlined
- Any background not already clear from the Preamble
- Why you are doing this Aim
- Hypothesis for this Aim
- Steps/some specifics/some techniques
- Expected outcomes/readouts

>> Option 1 for writing the Specific Aims — Start with a verb

(a) Start with a verb and what you are going to do to test your hypothesis for that Aim (bold this). (b) Add another sentence or two to if you think you need to provide more information about background; make the rationale for doing the aim clear. (c) State hypothesis if in hypothesis-driven area. (d) Briefly describe methods (optional). (e) State expected outcomes.

> *Sample wording for Option 1.*
>
> **Aim 1. Verb + what you are going to do.** *Our working hypothesis for this Aim is that ____. First, we will ___. Then we will ___. Finally, we will ___. A combination of __ and ___ methods will be used. We expect___.*
>
> **Aim 2. Test the hypothesis that ___.** *Prior studies and our preliminary data showed that ___. Here we will use ___ method to ___.*

>> Option 2 for writing the Specific Aims — Start with the 'WHY', then proceed as in Option 1

(a) Start with "To xxx", where xxx is WHY you are doing the Aim. (b) Then continue with your Verb + what you are going to do to test your hypothesis for that Aim. (c) Add another sentence or two to if you think you need to include more information about background or rationale. (d) State hypothesis if in hypothesis-driven area. (f) Briefly describe methods (optional). (e) State expected outcomes.

'WHY' is related to filling the gap/problem. The benefit of using Option 2 is that by stating the 'WHY' at the beginning of the Aim you help the reader to stay focused on your reasons why it is important to do this study.

> <u>Sample wording for Option 2</u>
>
> **Aim 1.** *To xxx (why we are doing this), we will **Verb + what you are going to do**. Our working hypothesis for this Aim is that _____. First, we will ___. Then we will ___. Finally, we will ___. A combination of __ and ___ methods will be used. We expect___.*
>
> **Aim 2.** *To xxx (why we are doing this), we will **test the hypothesis that xxx**. Prior studies and our preliminary data showed that ___. Here we will use ___ method to ___.*

Sub-Aims – these are optional

Sub-aims are the smaller steps you plan to do to achieve an Aim. Consider presenting them as bullets if a few discrete steps are needed to achieve the Aim and you want to make sure the reviewer understands those steps. If do you *not* choose to present your sub-aims as bullets, then you can denote sub-aims within the Aims descriptions by "first, second, third" or by "first, then, next, finally".

> <u>Sample wording -- for sub-aims or for regular aims</u>
>
> **Aim 1** *We will test the prediction that X.....*
>
> > *1A. We will manipulate X and measure Y …*
> > *Our hypothesis predicts …*
> > *1B. We will compare X to Y to determine ….*
> > *We expect to find …*
>
> **Aim 2** *Characterize the mechanism of …*
>
> > *2A. We will test whether X happens by Y….*
> > *We predict that …*
> > *2B. We will test the hypothesis that X by carrying out Y …*

3. Payoff Paragraph (some call it 'summary of significance')

This is sometimes referred to as the 'payoff paragraph' because it states what successful completion of this work will 'buy' the field and the broader community. I think it is helpful to think in terms of *benefits*, *value* and *potential*, with benefits being the direct outputs of the project; value being the broader implications (probably linked to the funder's immediate or mid-term priorities); and potential being longer term possibilities, linked to funder's long-term goals.

> <u>Sample wording for payoff paragraph—</u>*<u>you probably will not use all of these!</u>*
> *Upon successful completion of this project, we expect that the combined work in Aims 1 and 2 will _____(direct outcome). We also expect that Aim 3 will establish _____ (direct outcome). Over the longer term, _____ (value and/or potential).*
>
> *The proposed work is innovative because ___. This work takes advantage of our unique __. The impact of this work extends beyond _____(a narrow interpretation of the anticipated results) to*

Aims check up

- Set your Aims draft aside for a few days. Then read it ALOUD to yourself. Really ☺
- Redraft.
- Make sure the reviewer knows what innovative thing(s) you bring to the project
- Make sure you tried to put yourself in the reviewers' shoes to see things from their perspective
- Make sure the Aims page has addressed all the review criteria.
- Imagine the papers you will write: would anyone be interested? Would the results be believed?
- Ask colleagues and mentors to read (starting 2 months before the due date!!!) and tell you whether you convinced them that the project was important and that you could do it.

Sources

- Morgan Giddings, PhD, http://morganonscience.com. She gave me the idea to compile this document and expand upon her original Aims Template (as of 11/13/19 I cannot find her original template on the web); a good portion of the wording in the Aims Template is hers. Thank you!
- Martie Thompson, PhD, Research Professor in Public Health Sciences and Director of Center for Research and Collaborative Activities, Clemson University
  http://dle-mediasite-hehd.clemson.edu/Mediasite/Play/cbff0bde6a904cb3a54527167dfe4819
- Erica Whitney, Senior Research Development Analyst, University of California, Berkeley
  Ms. Whitney formulated an Aims template and much of the example wording in the Template comes from her work. Thank you!
  (http://qb3.berkeley.edu/qb3/careerworkshops/Specific_Aims_QB3.02_22_11.pdf - no longer there)
- The Grant Application Writer's Handbook- National Institutes of Health by Stephen W. Russell and David C. Morrison
- The websites of the NIH
- The many people I have worked with who have shared their experiences and recommendations.