What's in an Aims page?

- Specific Aim
- Gap
- Objective
- Central Hypothesis
- Expected Outcome

What's in an Aims Page?
Resource:

Stephen W. Russell & David C. Morrison

Writing Winning Grants

Grant Writers’ Seminars and Workshops, LLC

http://www.grantcentral.com

Resource: Template for Writing a Fellowship Grant
Why it matters that your Specific Aims page is well written

Overview of review at NIH:

• 2–3 reviewers among ~ 20 panel members will read in entirety

• these reviewers will present and discuss it at meeting — and give a preliminary impact score

• they may revise opinions based on discussion

• non-presenting reviewers will get overview from Specific Aims page (or Project Summary, which is shorter)

• all reviewers contribute to final “overall impact” score

Ultimately, reviewers who have read little more than your Specific Aims page will have a major influence on your overall impact score.
Final Priority Score

OVERALL IMPACT
The likelihood for the project to exert a sustained, powerful influence on the research field(s) involved:

- in consideration of the following five core review criteria, and
- additional review criteria (as applicable for the project proposed)

Review criteria from which the overall impact score will be derived:

**Fellowship (F) Applications**
1. Applicant
2. Sponsors, Collaborators, Consultants
3. Research Training Plan
4. Training Potential
5. Environment & Institutional Commitment to Training

For more on review criteria and scoring system, see
NIH Peer Review information page: [http://grants.nih.gov/grants/pa-review.htm](http://grants.nih.gov/grants/pa-review.htm)
### Major Sections of Fellowship Grant

1. Introduction to Application (Resubmissions)
   - **Introduction to Application (Resubmissions)**

2. Applicant’s Background and Goals for Fellowship Training
   - **Applicant’s Background and Goals for Fellowship Training**

3. Specific Aims
   - **Specific Aims**

4. Research Strategy
   - **Research Strategy**

5. Respective Contributions
   - **Respective Contributions**

6. Selection of sponsor and Institution
   - **Selection of sponsor and Institution**

7. Progress Report Publication list (Renewals)
   - **Progress Report Publication list (Renewals)**

8. Training in the Proposed Conduct of Research
   - **Training in the Proposed Conduct of Research**

9. Sponsors and Co-Sponsor Statements
   - **Sponsors and Co-Sponsor Statements**

10. Letters of Support from Collaborators, Contributors, and Consultants
    - **Letters of Support from Collaborators, Contributors, and Consultants**

11. Description of Institutional Env and Commit to Training
    - **Description of Institutional Env and Commit to Training**

### Review criteria from which the overall impact score will be derived:

1. Applicant
   - Biographical Sketch
   - Applicant’s Background and Goals for Fellowship Training

2. Sponsors, Collaborators, Consultants
   - Sponsor and Co-sponsor statements
   - Applicant’s Background and Goals for Fellowship Training
   - Letters of Support from Collaborators, Contributors, and Consultants

3. Research Training Plan
   - Research Strategy
   - Applicant’s Background and Goals for Fellowship Training
   - Sponsor and Co-sponsor statements

4. Training Potential
   - Research Strategy
   - Applicant’s Background and Goals for Fellowship Training
   - Sponsor and Co-sponsor statements

5. Environment & Institutional Commitment to Training
   - Description of Institutional Environment and Commitment to Training
   - Applicant’s Background and Goals for Fellowship Training
   - Sponsor and Co-sponsor statements

For more on review criteria and scoring system, see
Points that should be clear from Specific Aims page:

- Fellowship Applicant
- Sponsors, Collaborators, and Consultants
- Research Training Plan
  - Is proposed research plan of high scientific quality, and well integrated with the proposed training plan?
  - Is research project consistent with the applicant’s stage of research development?
  - Is proposed timeframe feasible to accomplish the proposed research training?
  - Based on sponsor’s description of his/her active research program, is applicant’s proposed research project sufficiently distinct from the sponsor’s funded research for the applicant’s career stage?
- Training Potential
- Institutional Environment & Commitment to Training

Example of funding agency expectations
NIH Individual Predoctoral Kirchstein NRSA Fellowships

- Should be:
  - specific
  - informative
  - non-redundant, and
  - **succinct**

- Will be evaluated for its:
  - research training potential, and
  - scientific merit
Research Training Plan:

1) Specific Aims page, no > 1 page (include 2–4 aims)

2) Research Strategy, no > 6 pages
   a. Significance
   b. Approach

Example of funding agency expectations
NIH Individual Predoctoral Kirchstein NRSA Fellowships

Research Training Plan:

1) Specific Aims page — **in one page or less and for 2 aims:**
   - Concisely state **goals** of proposed research
   - Summarize **expected outcomes** → including impact of results on research field
   - Include concise listing of **specific objectives** of proposed research, e.g.,
     - test hypothesis,
     - challenge existing problem,
     - address critical barrier to progress in field, or
     - develop new technology

2) Research Strategy, no > 6 pages
   a. Significance
   b. Approach

Example of funding agency expectations
NIH Individual Predoctoral Kirchstein NRSA Fellowships
Example of funding agency expectations
NIH Individual Predoctoral Kirchstein NRSA Fellowships

Research Training Plan:
1) Specific Aims page, no > 1 page (include 2–4 aims)
2) Research Strategy, no > 6 pages
   a) Significance: Describe
      1. importance of the problem or critical barrier to progress that the proposed
         project addresses;
      2. strengths and weaknesses in the rigor of the prior research (published and
         unpublished) that serves as the key support for the proposed project;
      3. how the proposed project will improve scientific knowledge, technical capability,
         and/or clinical practice in one or more broad fields; and
      4. how the concepts, methods, technologies, treatments, services, or preventative
         interventions that drive this field will be changed if the proposed aims are
         achieved.
   b) Approach

Example of funding agency expectations
NIH Individual Predoctoral Kirchstein NRSA Fellowships

a) Significance
b) Approach: Describe
   1. overall strategy, methodology, and analyses to be used…;
   2. potential problems, alternative strategies, and benchmarks for success;
   3. if the project is in the early stages of development, any strategy to establish
      feasibility/address management of any high risk aspects
   4. how relevant biological variables, such as sex, are factored into research
      designs/analyses for studies in vertebrate animals/humans
   5. Any procedures/situations/materials that may be hazardous to personnel and the
      precautions to be exercised
   6. If research on Human Embryonic Stem Cells (hESCs) is proposed but an
      approved cell line from the NIH hESC Registry cannot be chosen, strong
      justification for why
   7. If you are proposing to gain clinical trial research experience (i.e., you will not be
      leading an independent clinical trial), your role on the clinical trial

Project-specific "maybe" (only if needed)
Common reasons for grant rejection

- no clear hypothesis / well-defined goals (aims too independent)
- specific aims do not test hypothesis or are interdependent
- proposal is not mechanistic / scientifically relevant
- application is not appropriate for the funding mechanism
- proposal is overly ambitious
- preliminary data are lacking
- investigator(s) qualified to carry out proposed experiments?
- failure to cite key publications / experiments
- inadequate description of experimental detail, alternative approaches, data interpretation
- lack of relevance to institute’s mission

In shortened NIH grant format (since 2010) —
failure to clarify overall significance / too much emphasis on detail

Issues that are apparent from Specific Aims page

- no clear hypothesis / well-defined goals (aims too independent)
- specific aims do not test hypothesis or are interdependent
- proposal is not mechanistic / scientifically relevant
- application is not appropriate for the funding mechanism
- proposal is overly ambitious
- preliminary data are lacking
- investigator(s) qualified to carry out proposed experiments?
- failure to cite key publications / experiments
- inadequate description of experimental detail, alternative approaches, data interpretation
- lack of relevance to institute’s mission
Tips for writing the Specific Aims page

The present letter is a very long one, simply because I had no leisure to make it shorter.

Blaise Pascal (1623-1662)
Scientist, mathematician, physicist, philosopher, moralist & writer

Resource:
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Writing a 1-page Specific Aims section –

First step:
• generate a bullet outline to help you make the logic of your project clear to the reader

♥ helps to link ideas effectively and avoid excess detail

Background & Significance (of problem)
WHY?

Purpose
WHAT?

Plan
HOW?

Impact (of study)
WHY?

Specific Aim

Central Hypothesis

Objective

Gap

Specific Aim

Expected Outcome
The glaucomas are a leading cause of blindness in the United States, with over 2 million cases reported in 2005 and 3 million being projected by 2020 (1).
Writing a 1-page Specific Aims section –

Introductory paragraph:

- Current knowledge (2)
  - *purpose* — get all reviewers up to speed on current state of knowledge on proposal topic
  - should *not* be comprehensive — 2–3 sentences covering only information necessary to bring reviewers from most relevant older knowledge to edge of field
  - should set scene for presenting the gap (or unmet need)
  - bullets should lead reader to “jumping-off” point for application (i.e. *what needs to be done next*)

The absence of early and reliable detection…
Recently thin central corneal thickness (CCT), a highly heritable trait, was found to be ...
This feature is regulated primarily by…

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Writing a 1-page Specific Aims section –

Introductory paragraph:

- Gap in knowledge base (3a)
  - key to creating Specific Aims section — all downstream logic flows from it
  - statement of what is holding back your field (vertical change)
  - this gap must be addressed by proposed research

… but the basis for its link to glaucoma is not yet understood.
Writing a 1-page Specific Aims section –

Introductory paragraph:
- The gap (unmet need) as a problem (3b)
  - purpose — convey that this represents an important problem…
    i.e. that “vertical” advancement in the field awaits filling of the gap

Determining how CECs regulate CCT is expected to provide important insight into determinants of the onset of glaucoma.

By end of background/significance paragraph, reviewers should:
- understand why your research area is relevant to agency’s mission
- be up to speed with state of knowledge in the field
- understand the gap in the knowledge base, and that it is an important problem
Writing a 1-page Specific Aims section –

Purpose paragraph:

• Long-term goal (4)
• Objective of the proposed research (5)
• Central hypothesis and how formulated (6)
• Rationale (7)

Second paragraph:

• Long-term goal (4)

  » purpose — project the continuum of research to be pursued over multiple funding periods (by your lab, as relevant to agency mission)
  » must encompass the identified gap (unmet need)

Our long-term goal is to learn which characteristics of CECs can be used to effectively screen for glaucoma risk, and how CEC-based regulation may be manipulated for preventative and therapeutic purposes.
Second paragraph:

- **Objective of the proposed research (5)**
  - defines purpose of the proposed project (filling gap/unmet need)
  - must be realistic to achieve over a finite period of time
  - must clearly be the next logical step toward achieving long-term goal (linkage must be obvious)
  - must have a defined endpoint (not simply “to study process x”)
    - otherwise, when would you be done?
    - would overemphasize process, rather than product, of research

The **objective** of the proposed research is to uncover genes that influence CECs and to determine how CECs regulate CCT.

Second paragraph:

- **Central hypothesis … (6a)**
  - *purpose* — provide focus for your grant application
  - must link to objective
  - must give direction to project => the best bet for accomplishing objective
  - must be *objectively* testable (no predetermined conclusion)
  - should have components that are individually testable (by aims)

The **central hypothesis** of this application is that there is a genetic basis for CEC density, and that this in turn determines CCT and ultimately glaucoma susceptibility.

  - if unmet need application, provide best bet as to *how to meet the need*
Second paragraph:

- … and how central hypothesis was formulated (6b)
  - additional points to tell reader how central hypothesis was formulated, i.e. why you chose this as your best bet
    - based on preliminary data (if available)
    - based on the literature (complementary to your preliminary data?)

Our hypothesis has been devised on the basis of own preliminary data revealing that CEC density correlates exactly with overall CCT in 3 different genetic backgrounds of inbred mouse strains that model thick, intermediate, and thin CCT. This finding suggests a genetic basis for CCT and a relationship to CEC density.

Second paragraph:

- Rationale (7)
  - purpose — why you want to undertake this research, e.g. what will become possible that is not now
  - must link back to gap identified in first paragraph — whose resolution will allow you to take the important next step
  - opportunity to excite the reviewers!
  - the art here is to deliver this exciting message without repeating of the “gap as a problem” verbatim

The rationale for the proposed research is that the identification of genetic determinants of CEC density will make it possible to perform early and reliable screening to assess glaucoma risk, and open doors to new preventative and therapeutic approaches involving the manipulation of CECs.
Writing a 1-page Specific Aims section –

By end of purpose paragraph, the reviewers should understand:

- in general, what you plan to do
- that what you are proposing will fill the gap that you have delineated

Plan section (Specific Aims paragraphs) (8):

- brief, informative, attention-getting headlines conveying why the research is being done ***
- each followed by:
  - a focused *working hypothesis*
  - or
  - a brief description of approach (unmet need)
Aims “paragraph”:
- **Headlines (8a)**, two in number (parallel, complementary)
  - *purpose:* attract a reviewer’s attention and whet his/her interest
  - must link back to some part of your central hypothesis
  - should not be descriptive* (focused on what is being done); do not use words like “correlate” or “describe” if you have a hypothesis
  - make broad and open-ended
  
  **Specific Aim 2:** Determine the extent to which the mapped CEC loci influence CCT.

* In the case of unmet-need based applications, the aims will describe what will be done.

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Formula for a 1-page Specific Aims section –

Aims “paragraph”:
- **Headlines (8a)**, two to four in number (parallel, complementary)
  - make broad and open-ended
  
  **Specific Aim 2:** Determine the extent to which the mapped CEC loci influence CCT.

**Specific Aim 2:** Identify factors that influence CCT.

If you don’t know that CEC loci have an influence, broaden the scope of the aim.
Specific Aim 2: Determine the extent to which the mapped CEC loci influence CCT.

The working hypothesis for this aim is that loci affecting CEC density will have a corresponding positive or negative effect on CCT, as we found to be the case for the model locus cec1 in our preliminary data. This influence will be evaluated in the context of different genetic backgrounds through the use of congeneric mouse strains. (rewritten from original)

* IF you have more space, you may briefly indicate generally what kind of approach you will take after stating the working hypothesis.

Impact paragraph:

• expected outcome for aims (9)
• generality regarding positive impact (10)
Impact paragraph:

- **Expected outcomes (9)**
  - *purpose* — present all expected outcomes in one place (makes it easier for the reviewer to see how the aims collectively validate the central hypothesis)
  - must have at least one outcome per aim (but can ultimately be merged into 1–2 sentences)
  - each outcome must link to the specific aim that will produce it
  - each outcome should be specific enough to convince reviewers that this project can accomplish it

The expected outcome of our study will be knowledge of the genes that influence CEC density, and thereby also CCT and glaucoma susceptibility. (rewritten from original)

Impact paragraph:

- **Generality regarding positive impact (10)**
  - *purpose* — summarize general impact of expected outcomes
  - point out how the outcomes will collectively make a vertical advance in the field
  - point out how the outcomes will collectively contribute to the mission of the targeted funding agency

This will have an important positive impact in that these loci will represent specific risk alleles that can be used to evaluate glaucoma susceptibility and as target genes for preventative and therapeutic strategies targeting this disease. (rewritten from original)
Writing a 1-page Specific Aims section –

By end of impact paragraph, the reviewers:

- should know what return they can expect if they recommend funding of your application
- will hopefully be inspired to advocate your project

Make your bullet list using the template...
How this looks conceptually…

Opening sentence
Current knowledge
Gap in knowledge/why it matters
Long-term goal
Objective (proposed research)
Central hypothesis (or urgent need)
Rationale for study
Aims Title
Hypothesis of Aim
Expected outcomes
Broader impact
Impact on career goals

Or maybe more like this?

Opening sentence
Current knowledge
Gap in knowledge/why it matters
Long-term goal
Objective (proposed research)
Central hypothesis (or urgent need)
Rationale for study
Aims Title
Hypothesis of Aim
Expected outcomes
Broader impact
Impact on career goals
Lexicon for Specific Aims page bullet points

- **Opening sentence/topic**: What makes the proposed research relevant to the funding agency’s mission.
- **Current knowledge/background**: Just enough information to set the scene for the reviewers with regard to current knowledge on the topic.
- **Gap in knowledge/problem**: Statement of what is holding your field back from substantial progress, must be addressed by the proposed research.
- **Why the gap is a problem/specific nature of problem**: The substantive advance that needs to be made.
- **Loop-test goal**: The continuum of research of which this particular proposal is a part.
- **Objective of the proposal/purpose**: Must fill the gap that has been identified.
- **Central hypothesis and its basis**: The overall theory that will be tested by the proposed research, and the background (preliminary data and literature) that makes this theory. Must be able to test the hypothesis objectively.
- **Relevance**: What your research will make possible that is not possible now.
- **Specific aims statement**: Independent but related aspects of the central hypothesis, will be tested in parallel as far as possible.
- **Working hypothesis**: Statement of sub-hypothesis to be tested in an aim, to clarify its focus (must give indication of what will be tested and how).
- **Expected outcomes**: What you think the aims will accomplish.
- **Positive impact/contribution to knowledge**: How the expected outcomes will make a substantial advance in the Field.
- **How the proposed research is expected to contribute to the funding agency’s mission (the returns on its investment).”

Writing a 1-page Specific Aims section –

In expanding from the bullets, it will help if you start early enough to:

- take a break before starting to expand the outline into sentences and paragraphs
- get constructive criticism from colleagues (fellow students)
- cycle through making sure that:
  - each component meets its purpose
  - each component links to the others in the right way
  - the progression of the logic is linear
Writing a 1-page Specific Aims section –

Be sure to:

• leave nothing to the interpretation of the reviewers (spell out your meaning)

• italicize or italicize and underline (depending on font style) key words but don’t overdo it (with respect to frequency or style)

• minimize number of citations in this section (maximally linchpin references)

Grantsmanship Tips 101

GET FEEDBACK

SHOW YOUR DRAFT APPLICATION TO A COLLEAGUE

SHOW YOUR DRAFT APPLICATION TO A COLLEAGUE... WHO DOES NOT ALREADY KNOW WHAT YOU INTEND TO DO

SHOW YOUR DRAFT APPLICATION TO A COLLEAGUE... WHO IS NOT YOUR BEST FRIEND
Grantsmanship Tips

101

YOUR DRAFT REVIEWERS NEED TO UNDERSTAND

- What you intend to do
- Why you believe it is important to do
- Exactly how you are going to do it

IF THEY DON’T GET IT, YOU MUST REVISE YOUR APPLICATION.

LEAVE ENOUGH TIME FOR REVISIONS

Size Matters

- Mind the page limits – Grants.gov will reject the application
- Do not ‘overstuff’ by shifting content to a section where it does not belong (e.g., using Human Subjects section or appendix to spell out details of methodology)
- Use limited space thoughtfully and effectively – don’t waste space on reiterating points
- Make your application ‘read like butter’
Substance Matters

- Focus on the MAIN objectives
- Clearly link methods to AIMs/Objectives
- Know your audience – 3 (or so) assigned reviewers not all of whom have focal expertise in your area.

- Be FOCUSED, CONCISE AND SUCCINCT

- [http://public.csr.nih.gov/Pages/default.aspx](http://public.csr.nih.gov/Pages/default.aspx)

Style Matters

- **Proofread for typo’s** – they are not only annoying but detract from intelligibility
- **Organization** - look at CSR Reviewer Resources to see what the REVIEWERS are instructed to evaluate; map the organization of your application to the Reviewers’ expectations – Significance is critical
- **Reference citations** – make sure the references agree with the citations in the text; missing or erroneous errors are costly
- **Make figures LEGIBLE** with labeled axes