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Introduction to the Specific Aims Page of a Grant Proposal

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Abstract

Grant writing starts with crafting an effective Specific Aims page. This page should be a succinct combination of sales pitch and science. The Specific Aims page demonstrates a problem, a gap in current knowledge, and suggests a solution. It proposes aims that work toward a defended solution and reveal the impact of the proposal on the problem, the field, and future research. The language must be efficient and persuasive; the presentation must drive a reviewer to support the proposal. Here we present a refined recipe for an effective Specific Aims page.

Keywords

emergency medicine; grant writing; research; specific aims

Grant writing starts with the iterative development of a Specific Aims page. The Aims page serves as a concept sheet with project milestones, hypotheses, and the most important elements of the approach.[1] This page also serves as a master plan for the research proposal and ideally engages the reader as an advocate during review. The readers are review panel members that will advocate for or against your project during review. Grant reviewers often have significantly different research experience and training than the grant writer. Thus, this page must give the educated non-expert a basic understanding of the problem while giving just enough detail to indicate mastery, should the reviewer be an expert on the topic. An effective Aims page makes the case that the research is important, the methods are likely to be successful, and the applicant is the right person and team to do the project. While these goals seem simple, conveying these elements efficiently and coherently is challenging. If the Specific Aims page is confusing, boring, or overly controversial then reviewers may be lost as advocates. In contrast, effective Aims page predisposes the reader to stay engaged and eager for subsequent details. Although a grant cannot be won with the Specific Aims page, a proposal can be lost on there by confusing or alienating reviewers.

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Some grant writers chafe at the notion that they need to “sell” their ideas because the proposed science should stand alone as compelling and valuable. We posit that a grant proposal is both sales and science in different parts. We define the goal of grant writing as gaining financial sponsorship for planned work; like sales, a proposal requires marketing, tailoring, and a value proposition. In contrast, science requires content and intent, a hypothesis and approach, thus science is the research that will be conducted with sponsorship. The Aims page is the point of sale for planned science and written with the goal of research sponsorship. The target audience is the review panel, and the goal is to enlist reviewers as partners and advocates of the proposal. Table 1 describes similarities between elements of effective sales and grant proposals.

First, the Aims page should be written to an educated non-expert audience, saving the field-specific details for content experts in later sections. Also, the Specific Aims page should make the overall plan as simple as possible, but not simpler, including only “need to know” information. Demonstrating the depth of expertise and fine details of pilot data are best deployed in later sections of the grant; instead, identify the problem to study, educate the reader with background knowledge, and describe why the proposed study will successfully solve the problem. Generally, citations are minimized on the Aims page because they can distract the reader and will be included in the background section of the grant. Obey the “cultural norms” that vary by discipline or review group; for example, whether hypotheses or short descriptive approach statements are listed by aim or as a preamble. Consider adding a figure on the Specific Aims page. Simple figures, such as conceptual models or relationships among key variables, are encouraged to save words and provide visual reinforcement. While format may vary, all Aims pages should educate the non-expert reader on existing literature, identify a knowledge gap, propose a solution grounded in the aims themselves, and demonstrate the impact of the work.

Based upon our collective experience as grant writers, grant reviewers, and mentors to numerous externally-funded investigators, we have characterized effective Specific Aims pages with a “recipe.” Because there exists a recipe for success, and because of this page’s critical importance in review, this manuscript explains the four key components of an effective Specific Aims page (Table 2). This recipe for the Specific Aims page is an essential first step to successful grant writing; we conclude with overviews of formatting and writing style.

1. Introductory Paragraph

Paragraph 1 begins with a first sentence that is compelling, catchy, includes all pertinent key words, and conveys importance and impact. The typical broad first sentence that “bad things happen to many people” is insufficient as it does not telegraph appropriate expectations of what comes next; in fact, the rest of the paragraph should be predictable if the first sentence effectively frames the problem. A solid opening sentence tells the reader what condition the researcher will study, why it is important, and engages the reviewer to read on for the proposed solution. For example, in a proposal on thrombolysis in stroke, instead of a first sentence on all neurologic diseases, it could state the health impact of thrombolysis in stroke patients as a critical problem to solve. A too-broad sentence might be “Heart disease is the

number one cause of death in the US.” A reader could imagine any number of topics for the proposed study. A better opener could be “After cardiac arrest, therapeutic cooling after return of spontaneous circulation improves neurologic outcomes.”

At the end of the introductory paragraph, the reader has been introduced to the project and its relation to the agency’s mission, educated with a brief summary of important existing knowledge, and notified to the gap or critical need to be filled. One or two high level sentences on current knowledge is sufficient in order to balance goals of providing enough detail to ground the proposal in the literature yet not become esoteric, jargony, or lengthy. The Specific Aims page should briefly acknowledge major controversies that may subvert the importance of the proposal; further explanations must arrive in later sections, but this page must allay concerns even briefly in order to keep the reader moving forward. This should flow directly into the knowledge gap the researcher hopes to fill. Statements that clearly identify the problem should be used such as “these studies were limited by...,” “no one knows why...” or “a gap remains...” Ideally, the aims will directly address the identified gaps. For instance, a proposal for an intervention might have aims on prevalence, effectiveness, and safety; these concepts would have been highlighted as gaps. When addressing alignment with a funding agency, consider using terminology and language from the funding announcement. In summary, the first paragraph introduces the problem to be solved, educates the reviewer on what is known, identifies the knowledge gap that the planned study will fill, and relates the project to the funding agency mission.

2. Rationale Paragraph

Paragraph 2 describes the rationale for the proposed study. It is here that the researcher reveals the proposed solution to bridge the (previously identified) knowledge gap: a high-level proposal to fill the knowledge gap, why it is the right solution, and why this team is the right one to do it. Briefly describe and justify why this is the proposed approach to the problem, and why this team would be the group to achieve the aims. Assuming the reader is compelled by the significant problem and knowledge gap, why would this be the expected or desired study, and what about this researcher’s expertise, experience, or environment ensure success? The rationale for filling this knowledge gap and for the approach chosen to fill it is critical. Linked to this rationale, the researcher makes a case for him or herself as the person/team to achieve the proposed plan. This can be achieved simply with a brief statement outlining pertinent qualifications, an advantageous opportunity such as “...through the development of a novel..., we now have the unique ability to...,” or “based on our compelling pilot data.”

The rationale paragraph is an ideal location for an overall study objective. This may specifically identify the long-term goal of the research agenda and the specific goals of what the proposed project will accomplish. The objective statement, much like in a manuscript, succinctly outlines what the researcher will successfully accomplish with the proposed study. This objective must be realistic and achievable. A researcher should not propose to “cure cancer,” for example, but perhaps “improve the staging and treatment of resectable lung cancer.” The objective is then linked to a critical need or central hypothesis whose testing will achieve the global objective of the application. Take care that the objective is not

to test a hypothesis. Be sure to have a thorough plan for negative and null findings that will be explained in later sections. An ideal hypothesis is one in which any result actually advances the field of inquiry and can be explained in such a way (rather than we learned something, or we were wrong). In terms of critical need, it is especially desirable to have a “burning platform” for the proposed study. It may be urgent because it is timely such as when major health policy adoption hinges on a study result, when a gap is on the critical path to allow an entire field of study to progress, or if there is an advantage for safety and efficacy pending the outcome of the proposed study. Closing this section with a global objective or central hypothesis distills the justification made above to set up the subsequent specific aims. In summary, the rationale conveys why the research is proposed at this time and by the researcher specifically, and what will be possible after the study.

3. Specific Aims

Specific aims are treated as a paragraph although they are generally a list with some type of outline numbering. Taken as a whole, specific aims outline the key steps to fulfill objectives that address a critical need. Aims are clear, achievable, and directly related to the content provided in the preceding paragraphs, with no new terms or “first mentions” in the aims. Specific aims are specific with clarity and have a goal to achieve something. Within each aim, avoid redundant phrases, e.g. “in older male patients with prostate cancer.” Depending on the audience and reader expectations, aims may be written as incomplete sentences starting with action words, e.g. investigate, measure, estimate, implement. For instance, use “measure” rather than “determine whether,” and avoid heavily descriptive verbs such as “correlate, describe, explore, or investigate.” For some agencies it is expected that each aim has an accompanying hypothesis and experiment, or perhaps a short description of an approach with data source and analytic methods. Other agencies expect to see anticipated challenges and proposed solutions. These expectations can be garnered from mentors that have been successful with the funding agency or review panel members. It is common to think of each aim as generating a result that can be written as a manuscript.

Depending on the duration of the planned study, two to four aims are acceptable with three generally being “just right.” Two aims can be considered for grants of short duration or small dollars while four aims may be appropriate for large program grants that must fulfill more objectives. The aims directly reflect the scope of work and can help define whether the study is judged as too ambitious; pilot studies may have fewer aims. Some investigators will call out an aim as “exploratory” and expect a lower standard for feasibility, although we avoid these and recommend only proposing work that can be executed successfully and thus defended. As a matter of grantsmanship, a researcher may or may not conduct exploratory work, but it is risky to propose work that may appear weak in comparison to other aims. Sub-aims (e.g. 1a, 1b, 1c) may organize basic science experiments beneath an aim, which may benefit such a proposal. Sub-aims increase the complexity of the aims page, however, increasing possible confusion and decreasing clarity. Sub-aims may provide a reviewer with additional opportunity to criticize the approach, so they should be considered very carefully.

Avoid “aim dependency” whereby one aim cannot be completed if a prior aim fails. Strategies to avoid interdependence include utilization of separate populations or different

approaches. For instance, if one aim is to develop a new assay and a subsequent aim uses the assay for a hypothesis test, then if assay development fails the subsequent study is doomed. An alternative proposal may seek to measure the utilization of the currently used assay, test three alternative methods to detect the condition in question, and pilot the test with the highest sensitivity assay for the condition. In this way, the study will generate knowledge regardless of the success with the new assay. Similarly, one might aim to measure a problem across multiple institutions, determine the best environment for an intervention, and pilot test the intervention in the most controllable of these sites. Table 3 highlights additional “do’s and don’ts” for effective specific aims.

In summary, specific aims should be correlated with the central project goal and hypothesis. They should be conceptual rather than descriptive, flow in a logical sequence, have a clear purpose with a working hypothesis or statement of need, and each aim’s success should be independent of the success of prior aims.

4. Overall Impact Paragraph

It is a common mistake to overfill the background before the aims, leaving little page space after the aims for anything more than a generic statement of innovation and importance for human health and future studies. This closing Aims page paragraph outlines the expected outcome and highlights the health and scientific impact identified in the first sentence of the page. It is essential to describe in specific ways the proposed project will be of value to the funding agency, to the field of inquiry, and to society. If the proposal includes career development plans then outlining who the researcher will become as a result of the funding is part of the value. This paragraph also closes the loop back to the opening sentence, the impact from filling a gap, and addressing a critical problem. The closing paragraph may only be two or three sentences, but can address innovation and impact. This is also the place to suggest what a specific next study would be that builds on the proposed study. In summary, the last payoff paragraph reorients reviewers to the background and knowledge gap, identifies the innovation, delineates expected project outcomes, summarizes the project’s significance, and allows the reviewer a peek at the importance of a larger research agenda.

5. Formatting and Writing Style

Formatting elements, such as bolding, underling, fonts and margins are generally dictated by the funding agency. It is essential to keep the reader in mind by making it as easy on the eyes and as user-friendly as possible. In formatting terms this means that there should be as much white (non-text) space as possible; we recommend writing a complete Aims Page using 12 point font and one-inch margins before reformatting to narrower margins per agency allowances. Writers should be judicious and consistent in using emphasis with bold, underline, and italics. Experienced grant writers advise saving one style of emphasis, e.g. either italics or underline, for resubmissions in order to differentiate new material and telegraph responsiveness to prior critiques. When adding a figure to the Aims page, consider wrapping the text and placing figures on the left so that the font to has a left-justified straight edge. Because some writers prefer straight edges generally they use full justification, but proportional spacing is harder to read on the eyes so we recommend using left justification

as another step to keep the reader in mind. Font choice may be dictated by the granting agency, but it is generally accepted that sans serif fonts like Arial are easier to read electronically or on screens, and serif fonts like Times new Roman are easier to read in print. This is generally a preference as electronic submissions and PDF editing means that many reviewers never print paper copies but rather review proposals in electronic formats. We utilize Arial 11 point font with half inch margins for federal proposals.

Effective writing style and story-telling is the next step in developing a persuasive grant application. Writing style is a large topic beyond the scope of this guide, though we will provide a few recommendations that relate to the Aims page. Clarity and concision are key (e.g. use short words when there is an option such as “and” instead of “as well as” or delete unnecessary phrases such as “indeed”).[2] Write to reader expectations in terms of sentence structure and paragraph linkage. [3] Use active verbs when possible, use first person (“I will” or “we will” instead of “this study will”) and passive voice (“data were collected”) judiciously and when appropriate (e.g. when you as the researcher are needed in the action such as making choices to defend). Writers should use a topic sentence and then supporting material in a more journalistic style rather than the logical approach of starting broad and ending with the point. Storytelling approaches are highly effective features of persuasive Specific Aims pages. For clinical research proposals, a composite case can bring the human element of the scientific rationale to light in a highly memorable way; clinical translational proposals can also benefit from a human health implication of the science. The hallmarks of excellent scientific writing deserve their own full manuscript discussion, but these basic elements can help the grant writer develop an effective Specific Aims page.

6. Additional Resources

Successful Aims pages can help early stage investigators model their own proposals.[1] The more you read and review, the better your own Aims pages will become and you will find an approach that works for you; no matter your style, Aims pages will include the recommended background, knowledge gap, proposed solution, and impact elements. The National Institutes of Health (NIH) has their own grant writing workshop available through the Grant Writers’ Seminar and Workshops site (<http://www.grantcentral.com>).[4] The NIH provides writing tips,[5] others have “demystified” the grant NIH grant application process[6, 7] and the Center for Scientific Review has outlined the necessary components of NIH grants.[8] For grant writers interested in the historical elements behind developing a Specific Aims page and more depth from reviewers’ perspective [9] The Society of Academic Emergency Medicine (SAEM) has built an illustrative website with full grant examples (<http://www.saem.org/research>)[10] and webinars (<http://www.saem.org/saem-foundation/events/educational/webinars>)[11] and many additional related resources, include our webinar discussing this topic in detail, where we recommend researchers evaluate Aims pages with a checklist of effective elements (Table 4). In workshops on this subject, participants would use this list to assess their own Aims pages as well as another participant’s page.

The Advanced Research Methodology Evaluation and Design (ARMED, <http://www.saem.org/education/live-learning/advanced-research-methodology-evaluation-and->

[design-\(armed\)](#)[12] is a year-long program that leverages in-person workshops and webinars to train junior investigators to in research topics. The SAEM Grant Writing Workshop (<http://www.saem.org/annual-meeting/education/workshops/grant-writing-workshop>)[13] occurs at the Annual Meeting; it is a working session that allows investigators to further develop individual Aims pages. Both of these programs have nominal costs and most department Chairs are eager to support junior researchers with these opportunities.

Summary

This manuscript provides a recipe for writing an effective Specific Aims page using a simple four paragraph structure, and gave formatting and style recommendations. It is ideal to optimize Aims pages with readers who are educated non-experts who are not unfamiliar with your study as they most closely resemble review panelists.

Biography

Dr. Anne Libby, PhD, is Professor Emergency Medicine and Vice Chair for Academic Affairs at the University of Colorado School of Medicine, Department of Emergency Medicine. Dr. Libby's research expertise is patient-oriented outcomes research, specifically, the financing and organization of health care systems with a focus on behavioral health. She served 4 years on study section for the Agency for Healthcare Research and Quality. Her research and mentored training programs have been funded by federal sources (NIH, AHRQ) and national foundations (Robert Wood Johnson Foundation, Doris Duke Charitable Foundation). She co-founded the Education, Training, and Career Development Core of the Colorado Clinical Translational Sciences Institute, and founded mentoring and mentored research development programs in clinical and outcomes research.

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13. Grant Writing Workshop. [<http://www.saem.org/annual-meeting/education/workshops/grant-writing-workshop>]

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Table 1

Similarities: Sales and Grantsmanship

Sales	Proposals
Something special to offer	Significance/Importance
Good first impressions	Specific aims page
Context: prepared, knowledgeable	Background
Appropriate credentials, endorsements	Biosketch, Letters of Collaboration
Supporting documentation	Pilot data, publications
Clear, understandable message	Abstract, Approach

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Table 2

Four Components for Effective Specific Aims Page

Component Paragraph Summary	Issues Briefly Addressed
Introductory Paragraph	<ul style="list-style-type: none"> Educates reviewer by summarizing important knowledge
Significant problem, solving problem aligned with mission of sponsor	<ul style="list-style-type: none"> Identifies knowledge gap or critical need Identifies problem created by need that you plan to solve
Rationale Paragraph: What, Why, Who	<ul style="list-style-type: none"> Overall project goal addresses identified knowledge gap
Presents solution to the problem that successfully addresses identified need	<ul style="list-style-type: none"> Presents central hypothesis or statement of need Explains why you are pursuing this project Explains why you are pursuing this project Describes unique qualifications and research environment
	<ul style="list-style-type: none"> Describes unique qualifications and research environment
Specific Aims	<ul style="list-style-type: none"> 2–4 brief aims that address a critical need
Outlines key steps to fulfill objectives and address a critical need	<ul style="list-style-type: none"> Aims logically flow to tell the story of the proposed study Aims consistent with central hypothesis and support overall project goal Aims related, but not dependent on the success of another aim
Overall Impact Paragraph	<ul style="list-style-type: none"> Statement of innovation, novelty
Return on investment, value proposition for project and future inquiry	<ul style="list-style-type: none"> Specific expectations to be fulfilled by project Positive impact of the findings from proposal, specific future steps/next study Close the loop for the funding agency, presents mission in opening sentence

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Table 3

Specific Aims Do's and Don'ts

DO	DON'T
Write aims early and stay open to revision	State a hypothesis that you cannot test with the proposed methods
Use active verbs and massive parallelism, no first mentions in aims	Use verbs viewed as "too descriptive" like correlate, describe, explore, investigate
Consider a figure to illustrates the story, relation between aims	Use vague words and jargon
Write to non-experts, as compared to approach written to specialists	Propose a "fishing expedition," not essential to problem at hand or overall hypothesis

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Table 4

Formative Assessment of an Effective Specific Aims Page

Defining the Problem/Critical Need
Known about the subject
Knowledge gap(s)
The problem to solve due to the gap
Urgent/important about this as a priority problem to solve
Proposed Solution/Rationale
Central hypothesis/overall statement of need
Why choose this study to address the identified problem
Team’s qualification and research environment
Specific Aims
Major variables in each aim linked to gap
Testable hypotheses and planned interpretations for all findings
Alternative approaches for each aim in case of unexpected trouble
Payoff
Expected outcome and key learning from study
Innovation and impact of aims
One logical next research step if study is successful
Framing Using Only the Specific Aims Page
6 key words for the study
Project title in 200 characters/spaces

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