Writing the Specific Aims of a Grant Application
MD Anderson Cancer Center
Date: October 22, 2014

>> All right, good morning, or noon; we're right at noon. My name is Kathryn Carnes; I'm the Director of the Department of Scientific Publications. And welcome to all of you to the third event in this week's Celebration of Writing in Science and Medicine Week. This is a biennial event; we do this every two years. It's cosponsored by the Department of Scientific Publications and the Department of Faculty and Academic Development. As you can see on the slide in front of you right now, we have two more events coming up this week. Both of them will be in AT&T Auditorium. Tomorrow's event, of course, Responding to Peer Reviewers; we'll have people speaking from a variety of perspectives on how to do that. And then Using Twitter and Social Media to Promote Your Work: that will be Friday's panel discussion. So, we look forward to seeing you there.

But I know you're here because you really want to hear about the Specific Aims of a grant application—arguably, the most important page in the entire grant application, and so to talk with you about it today, I'm happy to introduce one of our most senior editors in the department, Sunita Patterson. Sunita?

>> We know that you all are working in a challenging funding environment. And a lot of good proposals are not getting funded. And so in that climate, grantsmanship can make a difference, and that's why we wanted to do a talk this week on grant writing. And as Kat said, we chose this topic, the Specific Aims section, because as you'll see in a moment, it's a really important section of the proposal. My goals today are to help you write a better Specific Aims section, a stronger section. And to make the process easier and less stressful for you, because I'm going to give you a model for writing it step by step that will be helpful to you in the future. I'm going to be focusing primarily on NIH proposals; R01 is my main focus. But a lot of the principles that I'm going to give you would be applicable no matter what funding mechanism you were working with.

What I'm going to talk about today is: First I'm going to review the NIH grant review process, how your proposal will be evaluated. And I know that a lot of you know this process or perhaps have participated on study sections yourselves. But I want to review it because it'll become clear why we're spending a whole hour talking about one page of the application. I'll put the Specific Aims section in context with the rest of the narrative portion of the R01 proposal. And then I'll give you a model for writing the section, paragraph by paragraph, with some examples from successful R01 proposals written here at MD Anderson. And finally, I'll give you some tips for writing and styling the Specific Aims section, and in fact, a lot of those do carry over to the overall grant application.

Just to review how the grant review process works: When you submit your grant, it will be assigned at the Center for Scientific Review to a study section—hopefully, the one that you've requested in your cover letter. Each study section gets 60, 80, 100 proposals to review per cycle. And a study section is composed of 12, 20, 25 people. And an important point to note is that these people represent a variety of disciplines. They're going to be basic researchers. They're going to be clinicians, biostatisticians, epidemiologists, perhaps other disciplines depending on the particular study section. So, you're really writing for a very diverse readership.

Of these study section members, three—usually three—will be assigned as reviewers. And they will read your entire proposal, all the different pieces you've prepared, start to finish. They'll have about a month to write up a critique that is a brief summary of your proposal and then strengths and weaknesses covering the five review criteria that I will cover in a moment. And these three reviewers will each assign a preliminary impact score for your proposal. Those scores largely determine which proposals advance to being actually discussed when the study section meets in person. In general, the top-half-scoring proposals will be discussed by the study section. And the bottom half usually are not discussed unless a reviewer is particularly excited about it.

So the first audience for your Specific Aims section is these three reviewers. You want them to be your champions, your advocates. You want them to be excited and enthusiastic about your proposal. And so, one of the things we'll look at is how to write the Specific Aims section to make it easy for them to review your grant, and therefore happy, more enthusiastic, and more likely to give you a good score.

The study section will meet for 1 to 2 days in person. And if your proposal is discussed, then Reviewer 1, the primary reviewer, will present your proposal. They will give a brief summary and then summarize the strengths and weaknesses that they saw and tell what their preliminary score was. And then the other two reviewers will add additional comments and tell what their preliminary scores were. Then the floor will open up for discussion and questions. And there'll be about a 15- to 20-minute discussion among the whole study section. Now, during that 15
or 20 minutes, that will be the time that the other 10 or 20 members of the study section have to look at your proposal. So that's where the Specific Aims section becomes so important: All of the study section will read that 1 page. Only the three reviewers will read the whole proposal. The other study section members might also look at the abstract, they might skim the Significance, Innovation; they might look ahead at the figures; if they have a particular area of expertise, they might look ahead to that particular section of your grant. But they won't have time to read anything in detail. And during the time that they’re looking at your proposal, they'll also be listening to the conversation, the discussion that's going on. At the end of the discussion, all of the study section members, the three who have carefully read your whole proposal and the others—the 10 to 20 others—who haven't, will all give a score, and those scores are equally weighted.

So the second important audience for your Specific Aims section is these study section members—that's going to be your main opportunity to speak to them and to convince them yourself why you deserve a good score. So, you're partially going to be writing that section for them.

Here are the implications from that process on what we're trying to achieve in the Specific Aims section. First of all, you want to excite your assigned reviewers so that after they've read the Specific Aims section, they are already interested and are intrigued and read the rest of your grant with attention and interest. You want to make it easy for the reviewers to write their critiques and prepare their talking points for the meeting. You want to make it easy for the other study section members to see why you deserve a good score. You want to be explicit and clear both in the Specific Aims section and really throughout the grant because you're not going to be there to answer questions; what you've written on paper is going to be all that they have to go by.

After the scoring is finished, then the proposals are forwarded to the funding institute. And that's where the actual funding decision is made. And so, I think it's important to think for a moment about the funding institute's priorities. In a way, a grant proposal is like a business plan that's being presented to investors. Investors are looking to invest in projects that match their goals and that will provide a return on investment. And in fact, the NIH website lists as one of its goals “a continued high return on the public investment in research”—that's one of the goals of the NIH.

So it's important in your proposal to make it clear how your project relates to the institute's goals—in the case of the NIH, enhancing human health and reducing disease. And make it clear that your project is going to result in a contribution toward that mission or a return on their investment.

Just a reminder of the narrative structure, the structure of the primary narrative portion of the R01 proposal: The Specific Aims section is 1 page; it's limited to 1 page. The Research Strategy is 12 pages, and it's composed of three different subsections: Significance, Innovation, and Approach.

And if you look at the review criteria that the NIH provides to the peer reviewers on the study section: they're significance, investigator, innovation, approach, and environment. You'll see that three of those—significance, innovation, and approach—correspond to subsections of the Research Strategy. Investigator: people judge from the biosketch, the letters of collaboration, maybe the details about personnel in the Budget Justification. And the environment: there's the Facilities and Other Resources section, the Equipment section. But remember that most of your study section is not going to be looking at all those pieces. And so, you'll see that we recommend hitting on each of these review criteria in the Specific Aims section so that you can speak directly to all the study section members about your strengths in these areas.

This is an excerpt from the NIH’s instructions for the Specific Aims section; this is what they specifically ask for. They ask for goals, expected outcome(s), impact on the research field(s) involved, specific objectives: to test a stated hypothesis, create a novel design, solve a specific problem, challenge an existing paradigm or clinical practice, address a critical barrier to progress, or develop new technology.

With that background, I'll introduce our suggested model for writing the Specific Aims section. And we've developed this model—we've largely drawn on Stephen Russell and David Morrison's workshops. They come in the spring; they come most springs. And they'll be coming again in March to do a day and a half of workshops here. Also, we have drawn on advice of David Kingsbury related to grant writing. And on our experience as editors; we've probably edited thousands of grant proposals in our department over the years, so that informs some of our suggestions as well.

We're suggesting four paragraphs for the Specific Aims section: an introductory paragraph; what Russell and Morrison call the "What, who, and why paragraph"; a specific aims paragraph; and a payoff paragraph. And I want to say up front that this is a model. What we like about it is that it's an efficient, 1-page way of meeting all of those goals that I mentioned and touching on all of the review criteria. But there are other ways to structure it; you can adapt this model to suit your particular project or the narrative flow that makes sense for your research.
Let's start with the introductory paragraph. This paragraph has three components. First of all, an introductory sentence that captures the attention of the reader. This sentence should orient the reader by starting with the relevance to human health or the institute’s mission, a high-level introductory sentence. That sentence is followed by probably a few sentences describing the background information that the reader will need to understand your project. So, very specific to your project, what is known about your research topic already. Bring the reader up to speed on your topic. And that should flow into what is unknown: what is the gap in knowledge that your proposal seeks to fill, or what is the unmet need that you're suggesting a solution for? What's the next critical step needed to advance the field?

I'm going to show you some examples. Dr. Boyi Gan actually wrote a proposal that was funded this year using this model for the Specific Aims section. And he has graciously agreed for me to use some excerpts from the proposal. And I'll also be showing you some examples from funded R01 applications from Scott Evans and Naoto Ueno. And some helpful discussion with Dr. Ueno also informed some of the tips that I'm giving you today.

Dr. Gan started his grant with this general sentence: “Tumor growth requires high energy and nutrient supplies.” And I want to contrast that with a sentence that I pulled out from later in his Specific Aims section that represents a common pitfall that we see when we're editing grant proposals, which is starting a little bit too specifically. So this will be an example of what I mean by that: “This proposal builds on our data suggesting that the FoxO-BNIP3 signaling axis ... defines a novel energy stress signaling pathway that regulates mTORC1 and cell survival.” When you think about the diverse disciplines sitting at the table, I think that this sentence is a little bit too deep into the subject matter for an orienting, beginning sentence; it's not a gentle easing into the field, especially considering that this is being read while a discussion is going on in the room.

I'm going to show you how Dr. Gan built this introductory paragraph. “Tumor growth requires high energy and nutrient supplies.” Then he follows with two sentences of background information. “As a result, cancer cells usually undergo various types of metabolic stress, including energy stress. Overcoming metabolic stress is a critical step in cancer development.” And this flows into his statement of the unknown. “However, how cancer cells engage strategies of metabolic adaptation to survive and grow under metabolic stress is not well understood.” And I’ve put in bold those words that signal that this is the gap in knowledge. So, we can assume that by the time we finish this project, we will know more about cancer cells’ ability to survive and grow under metabolic stress.

Here's another example from Dr. Evans. This is his general introductory sentence: “Pneumonias are a leading cause of death worldwide and are particularly lethal to patients with acute myeloid leukemia (AML), as both the underlying disease and its treatment impair immune function.” And let's contrast this with a sentence that I picked out from later in his Specific Aims section, which again, represents an issue that we commonly see. “This proposal investigates the cellular and molecular mechanisms of inducible resistance against acute myeloid leukemia (AML)-associated pneumonia.” The second example mentions AML and pneumonia, but for the basic researcher at the table, they may not fully appreciate how, you know, pneumonia plays a role in this clinical setting. And so the introductory sentence that he used kind of brought everybody into that clinical problem up front so that everybody could fully appreciate it.

Dr. Evans goes on to build this introductory paragraph with a number of sentences about what's known in the field. The proposal has to do with a novel combination of synthetic small-molecule Toll-like receptor (TLR) agonists. I'm not going to include all of those sentences. But just know that there're several sentences here of background information that lead up to this gap in knowledge. And I’ve added bold to show those indications of the gap in knowledge. “Despite significant recent advances in TLR biology, current models cannot fully explain the synergistic antimicrobial events initiated in the lung epithelium by this combination treatment. “Further, it is not known whether interactions with AML cells or AML therapy will negatively impact the cells and signaling pathways required to evoke protection.” So, we can expect that the objective of this application is going to address these gaps.

And Dr. Evans followed this statement of the gap with an additional statement of why the gap is important. “Thus, to assess the feasibility of use of this drug combination in AML patients and to maximize the protective benefits, it is essential to clarify the mechanisms underlying this phenomenon.” This is why we need to move forward on solving this problem.

So, by the end of the first paragraph, we're suggesting that you've presented information so that the reader can appreciate that there is an important problem or an important need that needs to be solved or met. And that provides a great basis for flowing into the second paragraph, which Russell and Morrison call the “What, why, and who paragraph,” which is where you're going to say how you're going to meet that need or resolve that issue.

This paragraph has five different components: the long-range goal; the objective of the application; central hypothesis;
rationale; why you, why here (I'll explain that in a moment). And this paragraph is going to speak to four of the review criteria: significance, approach, investigator, and environment. All of those are going to be addressed in the course of covering these five points.

So, first, the long-range goal. The purpose of this statement is to show the bigger picture—where you're headed with your research beyond the specific—how the specific project is going to fit into your ultimate goal that you're working toward. And it will encompass if you've thought through what your next steps are going to be as far as funding in the future renewals. This long-term goal should encompass that vision.

Here is Dr. Gan's long-term goal: "Our long-term goal is to study key signaling pathways in metabolic stress response in the context of cancer development, so as to enable the medical community to rationally target such pathways in the treatment of human cancers."

And the objective is the objective of your specific application; this statement defines the scope of the project that you're proposing. And it'll be the next step toward achieving the long-term goal. For example: "The objective of this application is to determine the roles of FoxO transcription factors (FoxOs) in energy stress response and tumor suppression in renal cell carcinoma." (FoxOs are members of the FOX (Forkhead box) family of transcription factors.)

Having stated the objective of the proposed project, then, if you're proposing a hypothesis-driven project, you would state that central hypothesis. Now there are some cases—I'm focusing on hypothesis-driven research because that is the majority of what is funded by the NIH. There of course can be specific funding opportunities or specific proposals where a hypothesis doesn't make sense. And a clear need exists that can be straightforwardly discussed and the rationale clearly presented. So, in that case, you wouldn't state a hypothesis if it didn't make sense. But for a hypothesis-driven project, you would state the hypothesis, which demonstrates that you have an end point in mind. And that you're not conducting a "fishing expedition," where you're kind of looking to see what might happen if you do this and that. And we suggest following the statement of the hypothesis with the basis for that hypothesis, the preliminary data or previous studies that helped you to formulate that hypothesis.

Here's Dr. Gan's statement: "The central hypothesis of our proposal is that the FoxO-BNIP3 axis plays a dual role in inhibiting both cell growth and cell survival in response to energy stress and that loss of FoxOs or BNIP3 is one important strategy by which renal cancer cells adapt to energy stress during tumor development." And he follows that with: "Our hypothesis is formulated based on our preliminary data that..." And then you have four points listed for different pieces of research that led to that hypothesis being formulated: "(i) inactivation of FoxOs..." and so forth.

So, then Russell and Morrison suggest presenting the rationale for the work, which is why you want to do the project. What will become possible after the project is completed that is not possible now? Dr. Evans presented that more when he talked about the gap in knowledge. And that's an example of how different structures can make sense for writing this section. But here's what Russell and Morrison would suggest. "The rationale for the proposed research is that studying the roles of FoxO signaling in energy stress response and renal tumor suppression will advance our understanding of how renal cancer cells bypass energy stress to survive and grow and will provide important insight for the development of novel therapeutic strategies or prognostic markers targeting metabolic stress in renal cancer development." And one thing I really like about this—all of the examples that I'm showing you—is that in each case, the writing is very clear and simple and draws along—I think that all of these proposals that I'm showing examples of did a good job of drawing the reader along and the diverse disciplines that might be reading the Specific Aims section.

Okay. Russell and Morrison suggest ending this paragraph with "why you, why here." And basically this is speaking to those criteria of investigator and environment that most of the study section is not going to have another way to evaluate personally. So, by including a sentence or two here, you can establish that you are qualified to do the research, that you have the right collaborations set up, that you have the needed resources, or whatever particular information might set apart you as being the perfect person to carry out this research project.

So, if you're trying to figure out what to put here, think about, if one of your competitor's proposals—your closest competitor—was also being evaluated in the session and maybe they had a similar proposal, what is it about your doing the work here at MD Anderson would have a bigger impact on this work being done than if another person did it at another institution. That might give you some ideas of what to include here as your strengths.

Here are a few examples. Well, one way you convey this is by having already discussed what your preliminary data or previous studies might have been. By describing those, you know, you've given your track record and shown that you have a depth of knowledge in this particular research area. But some other things you could include...
example I actually saw online that I thought was really good: “Building on our expertise in developing image processing and machine learning algorithms for high-throughput screening and on our established collaborations with leaders in C. elegans research,...” So, this author is talking about expertise and established collaborations. And I want to mention where I got this example: the National Institute of Allergy and Infectious Diseases has a very rich website regarding grant writing: how to write all the different sections and at least a dozen different examples of successful grant proposals that have actually been annotated with some of the strong points of those proposals. I've given you the link at the end of this presentation in your handout. And I highly recommend spending a couple of hours perusing their materials because it’s really very helpful. So, that's where I got--this is from one of the sample successful proposals that have been posted there.

Another example for what you might say: "Our decade of experience with this model" (experience) “and our concurrent study of protein-X expression in breast cancer specimens position us to quickly identify...” So here we’re talking about the opportunity for synergy between this study and something else that’s going at the institution that might enable us to translate this research faster than might be possible at another place.

Or here’s a good one for MD Anderson: “Because our clinic sees approximately 300 patients a year with this rare subtype, we will be able to...” and so on. So just think about what you have access to that strengthens your ability to carry out the project.

Having given all of this information that I’ve just described, do you see that there’s an element of storytelling involved? In that you've talked about where you've come from--how you've gotten to this point of wanting to do this project. And you're talking about where you’re headed with it. So I think that that can be kind of a compelling narrative for the reader.

Having given all of this overall information, now it’s time to become more specific and tell the reader how the hypothesis is going to be tested with the actual specific aims. This paragraph is usually very straightforward. Often there’s a–there’s usually a lead-in sentence or sentences with something like “We propose the following specific aims:" or “We will test our hypothesis through the following aims--following three aims:" And then Aim 1, Aim 2, Aim 3--a fairly straightforward format.

The aim themselves: I’ve seen anywhere from two to five; three seems to be the most typical number. If you have four or five aims, you are risking being called “overambitious.” So make sure that your aims are narrowly focused, very concrete, clearly doable within the grant period. And actually that’s good advice no matter how many aims you have: to make sure that those aims are focused.

In a hypothesis-driven proposal, the aims should be hypothesis driven. And so you’ll see that we suggest a working hypothesis for each of the aims. For hypothesis-driven proposals, we want to avoid descriptive language for the aims, and I’ll show you an example of that in a moment. The aims establish a framework for your experiments and benchmarks for success. So as you complete Aim 1, Aim 2, Aim 3, you are accomplishing the objective; the project is getting done. And so it provides the structure for the proposed study. And collectively, the aims feed back into testing together the central hypothesis; each aim should relate back to the central hypothesis, and together they should test it. And a final point is that the aims should be independent of each other, and I’ll show you an example in a minute of what that means.

Specific advice for how to present the aims: For a hypothesis-driven grant, here's a fairly standard format. Begin with the aim itself. The wording—we suggest wording it as a finite objective—what you hope to learn or why you want to do the aim—rather than as a method or process. And I’ll show you an example in a minute. And we suggest phrasing it fairly broadly and then using the working hypothesis to focus the aim and become more specific. And then we suggest ending the aim with a sentence or maybe two describing the methods that will be used. Just enough detail that the reviewers have a sense of what type of studies you're going to be doing. But of course, since you're limited to 1 page, there isn't room for a lot of detail there.

For a need-driven grant, the typical way to present this part would be in the form of tasks--Task 1, Task 2--and then the approach to accomplishing the task.

[You know what, I'm going to keep going just because I'm really tight on time and--but afterward I would welcome your question, OK? I want to respect ending at 1:00.]

I’m going to give you an example. This is an example we've used for a while in Scientific Publications. We really like the way that Dr. Ueno built this aim. “Identify the molecular mechanisms that account for paclitaxel resistance in human breast cancer cells." "Hypothesis: Paclitaxel-induced death of breast cancer cells requires a functional mitotic
checkpoints.” And then a sentence about the method: “Cultured breast cancer cells will be treated with paclitaxel, and the response of various molecular targets will be assayed.”

And so a couple of things I want to point out about how this aim is written: First of all, notice that we’re looking at what we want to learn from the aim or why we want to perform it. We want to identify the molecular mechanisms, versus if he’d written “Perform an assay” or something like that that was more process or method based. And another thing I want to point out is that the aim itself is worded quite broadly, and then it’s focused by the hypothesis. And the reason Russell and Morrison recommend doing it this way is that if, during this research, it turns out that the hypothesis was incorrect—that a functional mitotic checkpoint wasn’t relevant—then you could go into an alternative strategy (which you’ve laid out in your Approach section)—and find another way to still accomplish this aim. The aim would still be done, and you would’ve found out the molecular mechanisms—it just wasn’t what you had expected. And so that would be the argument for not being too specific in the wording of the actual aim.

And this is an example of how Dr. Evans formatted his aims. “Specific Aim 1. Identify the lung epithelial cell populations required for inducible resistance to AML-associated pneumonia.” And then it has its own hypothesis. “Hypothesis 1: Airway secretory epithelial cells are important contributors to inducible protection.” And then there are two subaims. And I won’t read them, but the thing I liked about them was that they include both the method that he’s going to use as well as what he’ll find out by using that method. So subaim 1a and 1b. [Pause]

>> So by presenting the specific aims, this is the way you’re presenting your approach to the study section.

I want to review three common problems that we see when we’re editing Specific Aims sections. The first common problem is what Russell and Morrison refer to as the descriptive aim. So, this is an example of a descriptive aim: “To determine the influence...” And the—greater specificity would be better here. So identifying intrinsic factors is a more endpoint-oriented wording for this aim. And the aim is made more specific with the working hypothesis there. You might have a descriptive aim if you have the words “compare,” “correlate,” “describe,” “catalogue,” or “investigate.” If you have one of those words in your initial draft of your aim, think about ‘What is it I want to learn by investigating this? ’ And then see if you can reword your aim to incorporate that more finite objective.

Another common problem, closely related, is the open-ended aim, and this is an example. “To explore the causes of differences in the response to drug X,” standing alone. Or “To study the causes” would be another commonly used word. And we would say that this aim is too broad because when are you done exploring, or when are you done studying? So again, more endpoint-oriented wording for the aim and then a working hypothesis to make it more specific still would improve the presentation here.

Finally, dependent aims are considered sort of fatal flaws. And here’s an example: “Aim 1. To determine whether differences in expression of growth factor X affect the radiotherapeutic response. Aim 2. To determine how the radiotherapeutic response changes in growth factor X-knockout mice.” So, if in doing Aim 1, we find that differences in expression of growth factor X don’t affect the radiotherapeutic response, then there’s no point in doing Aim 2. And so that would be considered a dependent aim.

The final paragraph of our model of the Specific Aims section Russell and Morrison call the “payoff paragraph.” And basically, here we’re talking about what the agency and the public will get as a result of your project.

So we suggest three components of this paragraph. Expected outcomes would be the products of the research. One—at least one per aim. A mention of how your proposal is innovative (to hit on that innovation review criterion). And then the impact of your work, how the success will advance the field or relate back to the mission of the institute or contribute to, you know, enhancing human health. So the expected outcomes and the impact are specifically requested in the NIH instructions for the Specific Aims section. And they speak to the significance review criterion. And then the overall impact, which is the score that the study section gives—the study section score is actually an overall impact score, taking into consideration the five review criteria that I mentioned.

So I’ll show you how Dr. Gan built this last paragraph. “As expected outcomes, our proposed studies will identify novel mechanisms of energy stress pathways, clarify the tumor suppression function of FoxO and BNIP3 in renal cancer, and provide important insights on the use of FoxO-BNIP3 expression in prognostic stratification of renal cancer patients.” These expected outcomes are speaking to the aims, the outcomes of each aim. “Our proposal is highly innovative, because it focuses on a previously unexplored pathway that fills in the current gap to link energy stress to renal tumor development. Our proposed studies will have significant impact on both understanding the fundamental mechanisms of energy stress signaling and manipulating energy stress pathways clinically in the stratification and treatment of cancer patients.”

http://www.mdanderson.org/transcripts/writing-the-specific-aims-of-a-grant-application.htm
And here's how Dr. Ueno covered innovation and impact. “The innovation in our approach lies in our use of a new cell-cycle profiling device... Our goal is to obtain preclinical results to prepare for prospective clinical trials in which the cell-cycle profiling device will be used to predict paclitaxel sensitivity in patients with breast cancer.” So it’s a nice—ending with an impact statement is a nice way to end the section and ends on a strong note, a powerful note, connecting back to the institute’s mission.

So again, what we like about this model is it accomplishes the goals that I set out before: it meets the instructions that the NIH gives for the section, it hits on all those five criteria, and it presents the information in a logical order that kind of tells the story of your research. But again, I want to say that—to feel free to use this as a starting point if you aren’t sure what to write or how to—what to include in the section. And then it may make sense when you’re writing to rearrange it or use some of these elements and not others as it makes sense for your particular project. I’ve seen lots of different formats for writing a successful Specific Aims section. But we like this one because it packs a lot of good information into a very concise format.

I want to now cover a few tips for making your Specific Aims section reader friendly. And remember, we’re thinking of the reviewer—helping the reviewers to pick out the important information that they want to include in their critiques and in their talking points. And then helping the other study section members be able to quickly spot these key pieces of information and be able to comfortably read your Specific Aims section while the discussion is going on in the room. So we have four different techniques we want to share with you for how to improve the readability of your Specific Aims section.

First of all, as I hope I’ve demonstrated, using simple, clear language that transcends disciplines is the way to go in the Specific Aims section particularly, but really throughout your entire grant. If you are proposing a basic science project, run your Specific Aims section by a clinician. If you’re proposing a clinically based subject, ask some of your basic science colleagues to read your Specific Aims section. They’ll be able to point out where you might be making assumptions that really need to be stated explicitly or where it’s not clear why you’re including some particular information and—why is this important, why does this matter, why did you put this in. You may need to add some connecting ideas or unspoken assumption that you made to make it more readable to a broad audience.

Inherent in writing simply and clearly, of course, define terms that might not be familiar to everyone on the study section, and avoid jargon. And of course, it’s hard to get too detailed in the Specific Aims section since you don't have very much space. But think about what details, like cell lines, for example, might not really need to be stated. Those are things that are in the Approach section if someone wants that level of detail. But they aren’t really needed for the high level of communication of the project that the Specific Aims is trying to accomplish. When—the more dense terms and abbreviations and so forth that you have in this section, the less readable the section becomes, the more dense. Especially when the people are distracted by a discussion going on.

I talked about—I think I talked about flag phrases—these are phrases that help the reader notice that oh, here's some important information that you’re looking for. So in Dr. Gan's examples, you saw that there were words and phrases that were underlined and italicized. And those were some of those flag phrases that we’re talking about. And so here are examples, many of which we’ve already seen, which show the reader: oh, this is what we’re presenting in this sentence, here’s the point of this sentence, here’s this important piece that you want to know.

We also suggest using transition words and transition phrases to link your ideas, to connect one sentence to another and help your reader follow your train of thought throughout the section. These can be very helpful with just telling the story and showing the relationship of different ideas to each other.

A couple of comments about formatting: Of course, NIH has very specific instructions about fonts, lines per inch, margins, and so forth. And of course, you need to be very careful to follow those. But in addition to those, we have a couple of recommendations. We suggest judicious use of highlighting such as italics, underline, and bold. You might try italics. If your fonts doesn't show italics very well, then italic and underline is good. I’ve also seen bold used. But remember to use it just for a few key phrases, maybe a sentence here and there. But if you use it too much, then it’s the same as not using it because everything will stand out instead of—you might as well have nothing stand out. But if you use it judiciously, then those key phrases will jump out at the reader and be a help to them; they’ll appreciate it.

Also, we suggest that the Specific Aims page be visually inviting—not too dense with text. And to that end, you can use white space very effectively to enhance the readability of the page. So, even though the NIH instructions say that margins need to be at least half an inch, we suggest for the Specific Aims section to consider using a full inch margin, just because it just makes the page more inviting and less intimidating to read while a discussion is going on. If your paragraphs are getting too long, if they’re that long [ Gesture ], you might consider breaking them into

http://www.mdanderson.org/transcripts/writing-the-specific-aims-of-a-grant-application.htm
smaller paragraphs that each focus on a smaller theme. Long paragraphs slow down readability; they’re harder to digest. And so, although I suggested four paragraphs, that four paragraphs could be adapted to five or even six. Between paragraphs, we suggest putting a little white space, if you can. That gives a visual break between paragraphs. If you don’t have room for a full blank line or blank space, then at least indent the next paragraph—put a tab in there, just to give a small visual rest.

And then, a final suggestion I want to make with regard to readability is to make sure that the section stands alone—is self-contained. References are not typically used very much in the Specific Aims section. You might have a couple of key references that you’re building on or that informed the basis for your hypothesis that you might want to mention. But in general, it shouldn’t be referenced heavily. Those references will be cited later in the Research Strategy. If you do cite a reference, use the author-year format rather than numbers. So that a knowledgeable person can tell exactly what reference you’re looking at—what you’re talking about without having to turn to the bibliography and find out what’s reference 2. It’s OK to include a reference to another section just in terms of—like “As discussed further in the Preliminary Studies section,” or something like that. But don’t make the section read such that the person has to go look up that information in order to understand the rest of your Specific Aims page. That page should be self-contained. You don’t want anyone to have to go somewhere else because most of the reviewers won’t have time to do that.

Finally, a figure can enhance this page. It’s OK to use a figure on this page. I would just suggest that it be a very simple figure. One that communicates very quickly with a glance and that more efficiently conveys some information than the corresponding amount of text would. So for example, if you’re talking about a signaling pathway, you would just want to pick out the key components that you’re talking about in your proposal. You wouldn’t want to have all the other related components and molecules shown there because that’s too complex to quickly digest. So simple figures can be helpful.

I want to say a word about writing strategies for the Specific Aims section. We suggest writing this section early, early, early, like months before your submission date. And for a couple of reasons: for one, it sort of serves as a template for the rest of the proposal. By the time you’ve thought through all the pieces that you’re including in the Specific Aims section, you’ll have done a lot of focused thinking that will just help you with clarifying your project and what you want to do with your project. So it’s a good way to just kind of clarify your plans. Also, by doing it early, you have a chance to circulate it widely. You can use it to recruit collaborators. You can ask for feedback, even from the funding agency. You can, you know, circulate it widely among all different types of people who can give you very helpful information. Your mentors; the colleagues who will be working on the proposal; colleagues in your department who are working in the same—perhaps the same disease site or the same type of research, but not your specific topic. And then, colleagues outside your department who, as I said before, they don’t know your topic well at all, but they represent the types of expertise that might be present on the study section. So, allowing time to use that feedback is very helpful.

And of course, the editors in the Department of Scientific Publications are here to support you. We are happy to read your draft Specific Aims. We’re also happy to edit your finished Specific Aims and your whole grant proposals. So please feel free to call on us for help with reviewing these things.

Let me give you a few resources. The Center for Scientific Review website has a lot of good information for applicants: how peer review works and so forth. The second bullet is a video of a mock study section. So, if you haven’t participated in one, watch that video, and you’ll get a very good idea of how the process works.

As I said before, the NIAID has a very rich website with lots of suggestions for all aspects of grant writing. And I’ve given the link for their suggestions on how to write the Specific Aims section, a little bit of a different take than ours. The annotated grant examples are at the link at the bottom of the page.

Our department has put a good bit of advice on grant writing on our intranet site, and there’s the link to that section. You’ll find some checklists for different pieces of the grant proposal, tips for formatting, dos and don’ts—a lot of different advice that dovetails with what I’ve said today and goes beyond it to the other sections of a grant proposal. The second bullet is the link—if you are planning to submit a grant proposal for editing to our department—we try to edit proposals in 5 working days, and it’s easier during heavy grant periods for us if you preschedule so that we can hold time available to edit your grant. So if you follow that link, you’ll find out how to preschedule your grant. If we’re just reviewing your draft Specific Aims, we can do that more quickly.

Please feel free to contact us with any questions any time. Our contact information is there. You can contact me directly (Sunita Patterson). I’m happy to answer any questions.
And then finally, I want to mention that Stephen Russell will be back in March for a full-day workshop on March 5th on Writing Winning NIH Grant Proposals. And then a half-day workshop on March 6th focused on career development awards. And I've given their website there, they have a very detailed workbook that they provide. If you attend the workshop, you'll get that workbook, but otherwise, it is available for purchase through their website. And it covers what I've said today plus a lot more, spanning the whole grant preparation process.

So with that, it's 1:00; I'll say thank you. I'll say good luck with your grant writing. We welcome your questions. Several of my colleagues and I will stay after, and please feel free to ask us any questions, and thank you very much.
[Applause]