*White Paper*

# R01 Research Strategy

## *Insider Tips to Ace the Most Important Part of Your Proposal*

Principal Investigator Leader

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President/Publisher: Samantha Saldukas ~ Vice President: Lacy Gaskins
Content Contributor: Dorothy E. Lewis, PhD ~ Content Coordinator: Stephanie Lane

Principal Investigator Leader
1854 Trade Center Way, Suite 201, Naples, FL 34109 USA.
Telephone: (800) 303-0129 ~ Fax: (239) 676-0146
Email: info@pileader.com ~ Website: www.pileader.com

# Introduction

The National Institutes of Health (NIH) spends the most grant money on R01 awards — in fiscal year 2016 alone the amount awarded in the R01 mechanism totaled more than $1.9 billion. Renewal grants awarded that year totaled more than $6.8 billion. But despite these huge amounts, the R01 is highly competitive and difficult to get — out of the 31,831 applications submitted in 2016, only 5,937 were funded. That's just 18.6%.

The R01 is also NIH's biggest research funding mechanism in terms of dollar amounts per award. As the "big fish" in the NIH funding pond, you're facing serious competition for the coveted R01 award. Therefore, your proposal must stand out among the crowd and inspire reviewers to push your application forward.

And one particular part of your proposal will make or break your chances of funding. The Research Strategy section of NIH's R01 grant proposals is the true "meat" of the entire application. You'll likely find yourself spending the greatest amount of time and effort on composing your Research Strategy — which is a smart thing.

NIH reviewers use the Research Strategy section to score your R01 proposal, because the three main components of Research Strategy directly correspond to the three primary criteria that NIH reviewers use to evaluate your proposed project. The three parts are:

1. **Significance** (why your proposed research is important)

2. **Innovation** (the way you want to solve the problem is new, novel, unique)

3. **Approach** (the strategy for how you choose to solve the problem)

The Approach section also includes Preliminary Data for new applications and Progress Report for renewal or revision applications. You should begin each section using the appropriate subheading: Significance, Innovation, Approach, and Preliminary Data or Progress Report.

***The snag:*** You have just 12 pages for your entire Research Strategy. That's not a whole lot of space for all this information, and most investigators struggle to get all the most important supporting arguments into this short page count.

NIH doesn't give you a specific way to divide up the 12 pages, but does make some loose suggestions of how to use your space wisely. Here's how you can break down your Research Strategy section:

- **Significance** — 1 to 2 pages
- **Innovation** — 2 to 2 1/2 pages
- **Approach** — 4 to 6 pages
- **Preliminary Data/Progress Report** — 3 pages

You don't need to stick to these page counts — they're merely suggestions. But you may find these page allocations helpful in planning out your best use of the 12 pages. Most important, you must choose your words wisely and stay to the point, warns **Dorothy E. Lewis, PhD,** professor of internal medicine and infectious diseases at the University of Texas Health Science Center.

## Before You Get Started...

Before you jump into writing an R01 grant proposal, you need to make sure you have a fantastic idea and hypothesis to test — one that's important and fills a gap in understanding, Lewis says. You have to be confident that your team specifically is the right one to do the work and that your work will have impact. Also, you'll need doable approaches to each objective in your proposed project that will yield meaningful data.

When it comes to writing an R01 proposal, you can't slap one together at the last minute — in fact, you should plan for at least two to three months of preparation time, Lewis recommends. Break the proposal writing down into manageable chunks, schedule time to work on it gradually, and follow that schedule.

To go after the R01 grant, you need to have an advanced degree at an appropriate institution, as well as preliminary data or published papers related to the proposed research, Lewis says. R01 awards are ideal for projects that require a bigger budget and a longer period of time to accomplish. Best bet: Read the proposal solicitation carefully before you even begin to think about applying for the R01 grant.

# R01 At-A-Glance: Top 5 Expert Tips

Lewis offers the following expert tips for seeking an R01 award:

**1) Make sure the proposed work is HOT.** If your research project is a hot area that NIH is interested in supporting then you may increase your chance of funding. The key is to find a niche with little information already out there and which you feel you are at the forefront of accomplishing. If you aren't sure whether your work is hot, look for similar papers and grant awards that are in line with your own research project and papers.

**2) Follow the rules.** Pay close attention to all the rules — big and small — like proposal format, page counts and length, and mandated proposal components. And make sure you understand your own institution's requirements and deadlines.

Also, understand the parts of your proposal that NIH reviewers will score:

- The potential impact your work will have;
- The approaches you'll take (are they feasible?);
- Your track record as a scientist;
- How hot your hypothesis is; and
- Whether you have believable data to back up your ideas.

**3) Don't skimp on your Specific Aims.** You might have two or three Specific Aims, and they should relate — but not depend on one another. You should be able to achieve each one regardless of the others. Provide data to back up each Aim if possible. Remember — this is your core idea and overall plan for solving the problem.

**4) Take special care with Approach.** Your Approaches will weigh heavily in the scoring of your proposal. Your Approach should answer questions — they should not simply be random experiments. Provide the rationale behind each experiment. You may not need to spell out the actual methods, but you do need to clearly explain the strategy and why it will yield answers.

**5) Always interpret your data.** When you're writing up Preliminary Data in the proposal, always provide an interpretation of the data and what it means to your proposed work. Providing data without proper interpretation is the biggest mistake that both new and seasoned PIs make in R01 applications.

If you don't interpret the data, the reviewer will think that you don't know what the data means, you're too lazy to tell the reader what it means, or you're being hasty and not conscientious with your proposal.

## Style: Beyond the Basic Rules

First and foremost, you must follow the style rules that NIH has for R01 applications. Use the correct font and margins, Lewis stresses. But also, remember that humans are visual, and reviewers will appreciate color, graphs, figures, visuals and models.

Try to find areas where you can illustrate your points using a graphic or model. Break up the text in your proposal using bold and underline font styles to make points stand out. Also, don't make your proposal one long paragraph — despite page limitations, you should always leave some white space and break up your thoughts appropriately.

While you're trying to revise your proposal for clarity and brevity, think about different ways you can communicate the information, Lewis suggests. Revise your proposal so that all your sentences are in "active" style, and not passive voice. Active voice is clearer, easier to read and proper, while passive voice is often awkward and leaves out important information. For example:

***Active:*** We have analyzed the results.

***Passive:*** The results were analyzed.

# *Significance:* Prove the Importance of Your Research

The first part of your Research Strategy is Significance. Simply put, Significance is the reason your research is important. Reviewers use this section to assign your proposal to the appropriate institute or center for potential funding. When a reviewer considers Significance, he's thinking about what would happen if your proposed project is successful and your Aims achieved — what would be the significance then?

According to NIH, you must include specific elements in your Significance section. Mainly, you need to explain:

- What's the **importance** of the problem you're trying to solve? Or, what **critical barrier** to progress in the field does your project address? Explain how your proposed research will answer:
    * Why the results of your proposed project are important;
    * How your findings will change science or medicine; and/or
    * Save lives or improve quality of life -- and how.

- How will your proposed project **improve scientific knowledge, technical capability** and/or **clinical practice** in at least one broad field? Explain how your proposed research will:
    * Fill any specific knowledge gaps in your field;
    * Provide new and unique research; and/or
    * Test new rationales for treatment.

- How will your project alter the **concepts, technologies, methods, treatments, services or preventive interventions** that drive the field? Explain how your proposed research will:
    * Advance your scientific field;
    * Meet the NIH's mission to improve health through science; and/or
    * Help to ultimately treat, cure or prevent disease.

## Break It Down: How to Simplify Your Significance Section

You have just one or two pages for your Significance section, but you have a lot of ground to cover in convincing reviewers why your proposed research is so vital to the field. So you must keep your thoughts extremely organized and concise.

You can break down your Significance section into about four paragraphs. In the first paragraph, you'll introduce the problem you plan to solve. Strategy: "Try to say in a sentence what your ultimate goal is," Lewis advises. What "big thing" are you trying to find out?

Support the magnitude of the problem by reviewing and citing published data in your field. But be sure to do so very carefully, presenting only relevant and current data — and avoiding outdated research, advises the National Cancer Institute (NCI).

Cite and discuss the literature to review what is already known, but don't make it a book report, Lewis agrees. Instead of making a list of all the related facts, tell the reviewer what he needs to know to understand why your strategies are superior. You can outline the key facts and publications that the reviewer needs to know to understand the significance of what you propose to do, she explains.

In the second paragraph, touch on the most important points supporting the introduction, providing additional background information as needed. In the third paragraph, describe the approach you'll use that will overcome any difficult challenges. "Then, state how you will meet this goal" via specific objectives or Aims, Lewis says. Show how you can build on this approach to develop a reproducible method to solve the problem.

Explain and highlight any potential barriers and alternative approaches related to your proposed research, NCI says. Bring forward any public health considerations as well. Highlight any experimental methods, such as new strategies or proposed interventions.

In the fourth paragraph, drive home your project's significance in a broader context. The true significance is that "what you want to find out should not be understood well," Lewis stresses.

Explain how others can apply your proposed research to the field or related areas, NCI advises. Also, prove that you can meet your objectives within the stated time frame. Make sure the Aims you've outlined are reasonable and feasible for the time frame given.

***Key:*** Your Significance is how your proposed research fits into solving the problem — a problem that nobody has ever solved before, Lewis notes. How does your data fit into solving the problem? Why are you the best person to solve this problem?

## Significance Vs. Impact: How to Tell the Difference

Many of the points you should include in your Significance section can help to support your proposal's Impact. But Significance is not the same as Impact. NIH reviewers look at Significance and Impact very differently.

Unlike Significance, Overall Impact is not a sixth review criterion, according to NIH. Impact accounts for the scored review criteria but is separate and distinct from these criteria. Reviewers rate Impact by integrating the five core review criteria (Approach, Innovation, Significance, Investigators and Environments) and the additional review criteria that are not scored individually.

***Bottom line:*** Significance is whether the project is important enough to carry out, while Impact is the value of what NIH gets in exchange for its grant funding at the project's completion. Both Significance and Impact are crucial to your proposal's success, because reviewers look at the two as dependent upon one another.

"A proposal could have Significance, but the Impact may be minimal — that is, the work is important to do, but in the end the impact to the field will be small," Lewis explains. So if you spend millions of dollars and all you find out is that the overall goal is unattainable, you've wasted the money.

***Inside look:*** NIH instructs reviewers to evaluate Impact based on the **likelihood** for the proposed project to exert a **sustained, powerful influence** on the **research fields** involved:

- **Likelihood** - Approach and Environment criteria.

- **Sustained, powerful influence** - Significance and Innovation criteria.

- **Research Fields** - Reviewers need to identify the research fields they believe the project will influence.

Because Impact is so essential to your proposal's ranking in the review process, you should attempt to "weave impact throughout the document," Lewis advises.

***Problem:*** What if your research won't affect a large group of people? If this is the case, you can make a translation argument — meaning you can argue that your results could lead to additional developments. So if your proposed research revolves around basic science, employing the translation argument for Significance is critical.

## SIGNIFICANCE SECTION EXAMPLE:

### Paragraph One — Introduce the Problem:

The development of an HIV vaccine that generates broadly-neutralizing antibodies remains an elusive goal. Recombinant subunit glycoprotein vaccines have generated antibody responses that neutralize laboratory-adapted strains (REF) or neutralize only very neutralization-sensitive primary isolates of HIV (REF). Recent studies of HIV-infected populations, however, indicate that up to 20% of individuals develop significant neutralization breadth (REF). Our laboratory has recently published results indicating that…

### Paragraph Two — Additional Background:

The structure and variability of the HIV envelope protein (Env) creates a significant challenge for generating an effective neutralizing antibody-based vaccine. Env is present on the virion surface as a trimer of heterodimeric gp120(SU)/gp41 (TM) subunits. Gp120 variable loop glycosylation is extensive, creating a barrier to access for antibodies known as the "glycan shield" (REF). The extreme sequence variability of gp120's exposed variable loops creates the need for either targeting highly conserved regions…

### Paragraph Three — Emphasize the Significance:

In this application we describe an approach that will overcome the difficult challenges described above. Using a polyvalent immunogen combined with a novel combination of molecular adjuvants, we hypothesize that a broad neutralizing antibody response against HIV primary isolates will be generated. Indeed, preliminary data presented later in this application are strongly supportive that this approach will be successful. Experiments described in this application will extend these finding to the SIV/macaque model, providing sufficient proof-of-principle to support the development of this regimen for human studies.

### Paragraph Four — Emphasize the Significance in a Broader Context:

Results from this study will be significant not only in advancing the development of new generations of vaccines for HIV, but will provide fundamental new knowledge regarding the nature of B cell signaling pathways and the adjuvants required to optimize affinity maturation in a vaccine context. Broad-based neutralizing responses may be of great benefit against a number of pathogenic viruses, including…

# *Innovation:* Show How Your Research is New & Unique

The second component of your Research Strategy is Innovation. How is the way you want to solve the problem new, different, novel and unique? This is your Innovation.

"Make the reader see that you have a novel aspect to solve a problem," Lewis says. This might be a new method, a different way of looking at the problem, or a fantastic team to do the work. "There are many ways the proposal could be innovative," she notes.

In your Innovation section, the NIH wants you to explain:

- How your project proposes to alter current research and clinical practice standards.

- Any new concepts, methodologies, approaches, interventions or instrumentation you propose to use or develop.
    * How are they better than what's already in existence?
    * How are your proposal's concepts and methodology new to your research field?

- Any improvements, new applications or refinements of theoretical concepts, interventions, instrumentation, approaches or methodologies.

You should also include any novel findings from the preliminary data, later detailing this data in the Approach section, advises the National Institute of Allergy and Infectious Diseases (NIAID). Additionally, you should explain how your study design and outcomes are new, novel or otherwise innovative.

Be clear when you're stating what is new and innovative about your proposal, and ensure that the reviewer understands why your proposed work is so ground breaking by providing any necessary background information and explanation. If your experiments work out like you expect, what is new and ground breaking about the information you'll obtain by the end of your project?

## Innovative Vs. 'Feasible': What You Need to Prove

You're all fired up about how innovative your proposed project will be and what extraordinary data you'll gather, but the reviewer might not be so eager to fund your project. Why? Maybe the reviewer doesn't think your big, new idea is very feasible.

You can propose something entirely new and ground breaking if successful, but you must prove to the reviewer that the idea is feasible, Lewis stresses. "The reader needs to see that what is proposed is possible — not fanciful, not "pie in the sky." Because reviewers are usually established PIs, being too creative in your proposal can make them doubt your realism.

***Bottom line:*** The more innovative your proposed research, the stronger your case should be to challenge the current models. According to Lewis, the two best ways to prove that your idea is innovative but still feasible are:

**1. Show the Data** — Make the reviewer believe in your argument by presenting logical, understandable and convincing data. And don't just present the data, but also explain what you think it means.

**2. Show Your Track Record** — Sure, your idea is extremely innovative and daring, but you're the investigator whose track record and past accomplishments make you equal to the task. Show your track record as a research scientist of solving problems and your expertise in the specific field. Also, emphasize your past innovative accomplishments.

Prove to the reviewer that your strategy is well-thought-out and that you've examined many different methods to reach your goal. Use everything you can to prove to the reviewer that you're capable of the job — your employment history, education, published works and past research endeavors.

## INNOVATION SECTION EXAMPLES:

Experiments outlined in this application will employ a novel approach to generate broad-based immune responses to HIV. While previous studies have established the value of generating HIV-specific T cell responses, they have fallen short in combining T cell-based immunogens with effective B cell immunogens. In this study, we will employ innovative B cell stimulation methods with…

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Our study is innovative because combining CryoEM tomography with high-resolution live cell microscopy represents a novel approach that will allow us to better define the intracellular trafficking of the Gag polyprotein. We have developed an innovative method of correlative microscopy, and will combine this with more conventional approaches to answer fundamental questions remaining in this field. For example, only through this technique will it be possible to define the morphology of Gag protein assembly intermediates…

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These studies are high risk, high reward, in that characterization of microparticles over gestation and in preeclampsia has not been done. The hypothesis that they are indicative of physiologic events in vivo is novel and testable. We have considerable expertise in flow cytometric methods and a long-term interest in maternal health. These attributes make us the ideal group to perform these studies. Coupled with the subset proteomics approaches, we will greatly advance understanding of the physiology of pregnancy and the development of biomarkers for preeclampsia...

# *Approach:* Choose Your Level of Detail Carefully

The Approach section is basically how you choose to solve the problem — how you will study each Aim, Lewis states. This section should describe how you are going to solve that specific Aim, including your experimental design, as well as some methods and preliminary data to support each Aim.

In the Approach section, the NIH instructs you to detail the following:

- Your overall strategy, methodology and analyses you plan to use to accomplish your Specific Aims (and if you have not included a separate resource-sharing plan, you should use this section to indicate how you will collect, analyze and interpret data, as well as any resource-sharing plans as appropriate).

- Potential challenges, alternative strategies and benchmarks for success that you anticipate to achieve your Aims.

- If your project is in the early development stages, note any strategies to establish feasibility and how you plan to manage any high-risk aspects.

- Any hazardous procedures, situations or materials and precautions you will use to address them.

In the first paragraph for Approach, describe the key area you're focusing on and highlight any new data, Lewis advises. If this is your own data that makes you think of a new method, state as such.

Ultimately, you need to provide enough explanation and detail in your Approach to make the reviewer confident in your idea. When you're mentioning your preliminary data or published work, tie it back to the "big picture," Lewis recommends. Explain how the data leads you in a logical progression to the next step.

## Focus on the 'Unique' Experiments

Explain your experiments in enough detail to show reviewers that you understand what the proposed study will involve and that you can effectively conduct the research, NIAID advises. Don't go into the same exhaustive level of detail that you would in a publication.

Really, there's a fine line between sufficient detail and too little detail, especially considering your tight page limits. If some of your planned experiments are routine, simply provide enough detail to explain them. But for any experiments that are unique and innovative, go into more detail.

Another way to avoid excessive detail is to refer to publications that describe your methods, instead of including the entire explanation in your text, NCI recommends. But keep in mind that, if possible, any publications you cite should be your own.

**Crucial:** You must also describe your alternative plan of attack and the various paths you might take based on the results of your experiments. Explain that if you get result X, then you will follow plan X, but if you get result Y, you will follow plan Y, NIAID states. Account for all the possible experimental outcomes, and then demonstrate to the reviewer that you've thought of all these potential outcomes and how you will proceed with your research based on the various possible results.

## Prove You're Qualified to Perform the Experiments

If you're an experienced investigator and have used the experimental methods or technologies before, you can state that and cite any relevant work, and then move on. But if you're a less-experienced PI and haven't used the technologies or performed the type of experiments proposed, you have a little more work to do in your Approach section.

Tie your personal statement and other Biosketch information into your Approach, highlighting what you do well and why you're distinctly qualified for this project, NIAID recommends. You need to assure the reviewer that you're the investigator for the job.

If you're using complex technology that you've never used before, illustrate how you're familiar with the experimental details and potential challenges, NCI advises. Keep in mind that if your own track record doesn't adequately support your qualifications for the proposed experiments, you may need to consider adding a co-investigator or consultant who is familiar with the technology or unique methods.

## Avoid These Common Mistakes

The Approach section especially can harbor a whole host of potential pitfalls and mistakes. Reviewers will look specifically to see if your proposal has one of these common mistakes:

- Your proposal is overly ambitious, considering the time frame and your qualifications/experience.
- Your Aims are underdeveloped or unfocused with no accounting for alternative approaches or back-up plans when an experiment yields unexpected results.
- One of your Aims is just a fishing expedition for a missing gene or interactions — you list a battery of experiments you'll try out. Don't just do experiments to do experiments — instead, make sure all your experiments are strategic.
- One or more Aims are just too risky.
- You provide too little description of results analysis.
- You rely too heavily on a preferred hypothesis.

What kinds of questions does the reviewer want answered in your Approach — specifically when you're describing each proposed experiment? There are several common ones:

- Why are you doing this experiment?
- What critical information will this experiment provide?

- What will it mean when you get the data from the experiment?
- What results do you expect to get?
- What happens if you don't get the results you anticipate?
- What is your plan if the experiments don't work?
- How will you confirm the data you get from each experiment?
- Is this experiment interesting to do or is it a critical, strategic experiment?
- Did you try these experiments before?
- What is your initial plan of attack? How likely is this plan to work?
- Have you carefully thought through the problem you're proposing to solve?

Back-up plans are extremely important in Approach. The reviewer wants to see that you might not know whether every experiment you propose will work, but that you have back-up plans, Lewis says. You need to convince the reviewer that you've thought through all of this, so that you'll end up getting meaningful results.

***Strategy:*** What you're really doing here is building the reviewer's confidence in you to achieve that big scientific breakthrough, Lewis explains. Build this confidence using your data, your track record, the big novel thing you've found and your new way of looking at the problem.

When you're addressing alternatives, use a heading like "Alternative Approaches," advises **Paul Spearman, MD,** professor of pediatric infectious diseases and division director of the Department of Pediatrics at Emory University in Atlanta. He offers an example:

***2G. Potential Problems and Alternative Approaches.*** *We realize that Aim 2 is an ambitious aim with multiple components. We have elected to present these experiments within a single overarching aim, rather than creating two separate aims, because the biochemical and microscopic techniques are designed to be complementary in reaching the same goals. We have considered alternative biochemical fractionation protocols to purify endosomes, such as a multi-step differential sedimentation approach. This was not considered as a first-line technique because of the high density of Gag complexes, which would result in co-sedimentation of all Gag complexes with the enriched endosomal fractions obtained in the final step of this type of separation. However, our separation technique is still under revision and will be modified as needed to produce the best separation of endosomal and plasma membrane markers. For the microscopic techniques proposed, we will benefit from the expertise of many individuals associated with the Vanderbilt Cell Imaging Core Facility and from our collaborator Dr. Smith. We will seek additional control fluorescent fusion molecules as markers of specific vesicular compartments during the conduct of this project. We will be careful to assess effects on cell viability and consider indirect effects on Gag/Vpu trafficking that may result from these interventions. Finally, we have considered alternatives to our model. The compartment in which the cellular inhibitor resides and in which Vpu acts may not be identical to the LE, MVB, or RE. If this is the case, we will seek counsel with other experts at our institution and others to suggest alternative vesicular compartments that may be involved and to provide markers that will identify these compartments.*

## Additional Details You Might Add to Approach

You need to save up page space for your Approach section, because there are so many components required here. In the end, your Approach section will likely be the longest of the Research Strategy sections. In addition to NIH's mandated components in Approach, depending on the nature of your proposed work, you might want to add some additional details like:

- A timetable illustrating how and when you'll accomplish your Specific Aims, pointing out any overlap of experiments and alternative approaches.

- Milestones and time lines, assessing whether they're appropriate.
- Your strategy to address high-risk aspects and to establish feasibility for early-stage projects.
- Why you'll use one method over others, showing that you didn't overlook any alternative approaches.
- Letters from individuals involved if your proposal involves collaborations and offers of materials or reagents with restricted availability.

## How to Organize Your Approach Section

There are several different ways to organize your Approach section, and NIH allows you to choose the organizational method that works best for your proposal. Keep in mind, however, that some I/Cs do require a certain organizational structure.

You might place your preliminary data at the beginning of your Approach section, or you might put the pieces of data with each Aim, Lewis says either way will work. Usually, you'll detail your experimental design, along with some methods and preliminary data to support each Aim. Here are three different ways you might organize your Research Strategy:

**Option 1:**

- Significance
- Innovation
- Approach
  * Preliminary Studies
  * Aim 1
  * Aim 2
  * Aim 3

**Option 2**

Approach

- Aim 1
  * Significance, Innovation, Approach

- Aim 2
  * Significance, Innovation, Approach

- Aim 3
  * Significance, Innovation, Approach

- Preliminary Studies/Progress Report

**Option 3**

- Aim 1: Preliminary Studies, Significance, Innovation, Approach
- Aim 2: Preliminary Studies, Significance, Innovation, Approach
- Aim 3: Preliminary Studies, Significance, Innovation, Approach

Keep in mind that you have very limited space, so some of these options may not work. For instance, Option 2 may not work for many proposals, because placing all three sections under each aim will be difficult with the current page limitations, Spearman says.

***Tip:*** Veteran NIH reviewers are most used to seeing Preliminary Studies or Progress Report in a separate section, so you may want to do it that way.

# *Preliminary Data/Progress Report:* Cite the Most Important Data

For new R01 applications, you'll need to include Preliminary Data, while for renewal applications you'll need to include a Progress Report. The sections for Preliminary Data and Progress Report are included in the 12-page Research Strategy.

NIH instructs reviewers to not place as much emphasis on Preliminary Data for early-stage investigators as they do for more established PIs, but you still need to detail your preliminary studies, data and experience directly related to the proposed project. Like the other sections, Preliminary Data is a key area in your proposal to help build the reviewer's confidence in your ability to take on the project.

***Best bet:*** For Preliminary data, show only the best, most convincing data to support your arguments, Lewis advises. Take the "less is more" approach for Preliminary Data, and detail fewer data while explaining more. Avoid any extraneous information and ensure that all data presented are what the reviewer really needs to know.

So not only should you present the most pertinent Preliminary Data, but you also need to interpret the results and describe what it means to your proposed project. According to the NIAID, here's what you need to do:

- **Demonstrate feasibility.** Show that you have the necessary expertise to conduct the experiments you propose. Also, show that you're on the right track by presenting Preliminary Data that support your hypothesis and research plan.

- **Be critical.** The reviewers will be critical of your results, so you might as well beat them to the punch. Critically interpret your preliminary results and detail any alternative meanings of the data to demonstrate that you've thoroughly considered the problem.

- **Show you know what you're talking about.** Include enough information about Preliminary Data to sufficiently explain how this early data has prepared you for the proposed research. The amount of data you'll need to present should be proportional to the complexity of your proposed project.

- **Highlight your own data.** Although you can include Preliminary Data from other investigator's work, present your own preliminary or unpublished data first and foremost. Be sure to identify what results are from your lab's work versus other people's publications.

- **Outline your previous experience.** Present some of your prior experience supporting that you have the ability to head up the proposed project and achieve its Aims.

## What Kinds of Data You Should Present

When you're thinking about the Preliminary Data that will really make your application shine, think about how the positive/negative results and the studies' statistical power will affect reviewers' perceptions of your proposed research. For example, if you're citing a study that had positive results with adequate statistical power, the reviewer might question why you need to conduct the proposed research because you already have strong evidence supporting your hypothesis.

A past experiment with null or negative results and adequate statistical power might tell the reviewer that your Preliminary Data is showing you failed to get results even though you had enough power to do so.

Conversely, if you had null or negative results but inadequate statistical power, you could point out that you couldn't differentiate between the means as not to be believed or is a product of chance, according to **William Gerin, PhD,** professor of biobehavioral health and director of the Mind-Body Cardiovascular Psychophysiology Laboratory at Pennsylvania State University.

***Ideal:*** Your most desirable outcome is positive results and inadequate statistical power. If the statistical power was insufficient to detect effects, you are on the right track with your preliminary studies and your results support the replication you're proposing, Gerin says.

## What to Include in Your Progress Report

If you're submitting a renewal or revision application, you'll need to include a Progress Report. In about one or two pages, you'll need to demonstrate your progress toward achieving your Aims. Specifically, NIH wants you to include in your Progress Report:

- **Beginning and end dates.** Cite the beginning and end dates for your project period, meaning the period covered since the last competitive review.

- **Your findings.** Provide a summary of your findings and their importance as they relate to your Specific Aims. First, restate your Specific Aims, and then write a narrative summary of the progress you've made for each Aim.

- **Published and unpublished results.** You don't have to relist your publications, but instead you will upload them as a separate document. Be sure to highlight in the results your progress toward achieving your Aims.

# CONCLUSION

When it comes to R01 proposals, everyone can use all the help they can get. Your Research Strategy section is crucial to your R01 success, so be sure to give yourself plenty of time to think about and write this section.

And as you're drafting the proposal, keep in mind that new and veteran investigators alike can make common — but nevertheless serious — mistakes. Spearman offers the **top 10 mistakes in R01 grant writing:**

1) The hypothesis/basic premise is flawed.

2) The problem is not significant.

3) The investigator lacks sufficient expertise or prior experience in the area of proposed study.

4) The Specific Aims are not carefully thought out and logical.

5) The proposal is overly ambitious (common for early-career PIs).

6) The methods are difficult to follow or are stated in general terms rather than specific experiments.

7) The proposal does not acknowledge alternative approaches.

8) The scope of the work does not fit the funding mechanism.

9) Proofreading is poor, including references and figure legends.

10) The Aims are dependent and do not stand alone. ■