PDF Transcript

NIH K | GRANT FUNDING

Step-by-Step Tactics to Get Funded Easier and Faster

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He is a PhD-trained medical researcher and educator with over 40 years’ experience in government, academic, and biopharmaceutical settings. His PhD training was in immunology and cellular biology, and he previously conducted research for several medical institutions in the United States. Dr. Dant was trained in grant writing at the NIH, and worked as a senior writer and managed publications at Stanford’s Medical School. He also established and built the Clinical Publications Division at Genentech in California. Until recently, Dr. Dant served on the faculty at Dartmouth Medical School and Norris Cotton Cancer Center to deliver lectures on NIH grant writing and manuscript writing. He lectures widely in academic and biopharmaceutical settings on manuscript writing, NIH career and research grants, and basic scientific writing skills for scientists. His business, MEDCOM Consulting, serves academic clients to review and write Research and Training Grants for the NIH.
INTRODUCTION

Today, I'd like to talk to you about a really successful program at the NIH. Career Development Programs have been around since the 1960s, and are one of NIH's most profitable and widespread programs. They have trained thousands and thousands of investigators to become independent researchers. This lecture is one I've given at other institutions I've worked for, namely Stanford, UCSF in California, as well as Dartmouth where I was a faculty member helping investigators develop their K and R grant applications.

This lecture is part of a development I did with NIH and has been vetted by the NIH. I used to collaborate with them regarding the grant information that universities should receive from NIH.

Today, I want to talk about Career Development Awards. While they are part of a bigger program and I will mention other types of training awards, I'm going to be focusing on the career development ones.

The first thing I really want to emphasize is that “The success of biomedical research rests squarely on the robustness of the NIH training programs.” In other words, the NIH wants to make sure that our workforce across the United States is prepared to train the next generation of clinical and basic research investigators; it's a program that they're very invested in it.

The NIH has made some incentives for this in recent years.

- They've modified and added more K08s and K23s in an effort to recruit more medical doctors.
- They've expanded the very popular K99/R00 program (or the Kangaroo, as it's affectionately called at the NIH) across all Institutes.
- They've increased the number of awardees transitioning within five years to R01s, the granddaddy of the R grant.
• They've added new opportunities to the New Innovator and Pioneer Awards, which are two of the more popular training grants.

Some of the NIH investments for early, new investigators (i.e., postdoctoral fellows or those within five years) are:

• **Fellowship grants.** Some of you may be on a fellowship using the F32 or T32 training program
• **K awards** which are the career development awards that I will talk about here
• **New Innovator Award** for high-risk, high-reward research which provides one and a half million dollars in direct cost.
• **Early Independence Award** at $250,000 a year for five years.

I will talk a little bit about the K Award reviewer viewpoint. *What kinds of things do they want to see?* I'm going to help you to align how you write your K Award to those viewpoints.

As many of you probably know, the NIH has 27 Institutes. They're very different in many aspects, such as:

• the way their mission is stated,
• what their budgets are and what activities they support,
• how they do things.
• their websites (which have different K emphasis)

**In other words, they have their own personality.**

When you're planning to submit a career award, first check with the Program Officers at the Institutes you’re thinking of applying to and determine their specific policies and interest in your application. This is extremely important, and I can show you where to find that information.

K awards, in general, are for **US citizens, noncitizen nationals, or permanent residents**. If you don't know the difference between those, you will need to look it up. Generally, it's very easy
to find that information on NIH’s website. The only exception to that is the K99/R00, for which you don’t have to be a citizen, but the work must be conducted at a U.S. institution.

**All require a minimum of 75% effort to research and career development activities.** This becomes a problem for MDs who are seeing many patients in addition to teaching. The way around that, of course, is to say the teaching and patient activities are directly related to my research.

**Previous PIs may be ineligible.** If you have been on an R01 grant, you would not be eligible for a mentored career award. You might be eligible for a more mid-career K. Today, I’m talking only about the mentor awards. The principal investigators on an R03 or R21, which are small research or exploratory research grants, are eligible (except for the K99/R00). If you’re a principal investigator in R01 or subproject principal investigator (on a P01 or a Program Project grant), you’re not eligible to apply for one of these mentored career awards.

**Type of Career Awards**

Here is a list of the most popular career awards.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
</table>
| K01*     | Mentored Research Scientist Development Award  
Career development in a new area of research—3 to 5 years |
| K07      | Mentored Career in Cancer (only NCI)  
Career development of junior investigators with MD/PhD for cancer-focused academic researchers in cancer prevention, cancer control, or the behavioral or population sciences. |
| K08*     | Mentored Clinical Scientist Research Development Award  
Career development for those with clinical doctoral degree in biomedical/behavioral research, including translational research—non-patient research—if patient research, see K23. |
| K22*     | Mentored Transition Career Development (only NCI)  
Career transition award to individual postdoctoral fellows in transition to a faculty position. |
| K23*     | Mentored Patient-Oriented Research Career Development Award  
Development of the independent research scientist for patient research—if not patient-oriented research in biomedical area, see K08. |
| K25*     | Mentored Quantitative Research Career Development Award  
To foster interdisciplinary collaboration in biomedical research by supporting career development experiences for scientists with quantitative and engineering backgrounds. |
| K99/R00  | NIH Pathway to Independence Award provides 5 years’ support in 2 phases:  
I. 1-2 years of mentored support for highly promising postdoctoral fellows.  
II. Up to 3 years of independent support contingent on securing an independent research position. |

*Includes award to promote diversity
Now, there are more K awards than are listed here, but the main ones are the K01, K08, K23, and K25. There’s a couple of others, such as the K07 and K22, that a lot of people don't know about (I'll just mention them briefly).

**The K01 is the general research science development award.** It’s development of a career in a new area of research and is funded for three to five years.

**The K07** is only available at the NCI (National Cancer Institute), and it’s for more junior investigators performing cancer-focused research in prevention, control of cancer, and the behavioral population sciences at the NCI. There's a specific RFA (or Request for Application) for this.

**The very popular K08 and the K23** are for MDs and MD/PhDs involved in traditional, non-patient research. It would be for somebody, for example, who's looking at certain targeted therapies for pancreatic cancer; they are looking at samples of patients with pancreatic cancers, developing certain antibodies against them, and testing them in mice. The K23 is more patient-oriented and is for those MDs who are doing work with actual patients. This could include an early clinical trial.

**The K25** is what they call mentored quantitative research. This is research for quantitative and engineering folks. For example, I worked at Stanford in a lab that did brain imaging. One of the investigators was a PhD in biomedical engineering, and he wanted to develop an algorithm to visualize brains from MRI scans that would indicate areas of higher or lower activity. He developed this beautiful algorithm through a K25 award.

**The K99/R00**, or Pathway to Independence, is a very popular award. It has two sections: *one to two years of mentored support for highly promising postdoctoral fellows*, and *up to three years of independent support* for doing R00 research. This is contingent on securing an independent research position at a university. It could be the same university you’re working at or another.

It's for mentoring for two years and covers salary plus research expenses. The R00 then transitions the awardee to independence as a junior faculty for up to three years. As I mentioned, this requires a tenure-track, full-time assistant professor position (or equivalent)
before you can proceed. Applicants cannot have more than five years of postdoctoral research at the time of their application. Non-U.S. citizens may apply, but the institution must be domestic as mentioned previously.

If you look at 2017 success rates at the NIH, these are success rates that define how many grants are submitted and how many awards have been made in percentages.

<table>
<thead>
<tr>
<th>K</th>
<th>TYPE</th>
<th>All NIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>K01</td>
<td>Mentored Research Scientist</td>
<td>31.5</td>
</tr>
<tr>
<td>K07</td>
<td>Academic Career Award</td>
<td>14.5</td>
</tr>
<tr>
<td>K08</td>
<td>Mentored Clinical Scientist Career</td>
<td>43.6</td>
</tr>
<tr>
<td>K22</td>
<td>Career Transition</td>
<td>18.5</td>
</tr>
<tr>
<td>K23</td>
<td>Mentored Patient Oriented Research</td>
<td>34.0</td>
</tr>
<tr>
<td>K25</td>
<td>Mentored Quantitative Research</td>
<td>23.5</td>
</tr>
<tr>
<td>K99</td>
<td>Pathway to Independence</td>
<td>23.4</td>
</tr>
</tbody>
</table>

As shown in the diagram, the average success rate of K grants in 2017 is 30.6%. A lot of people might not think that is very high, but it is when you compare it to the 18.7% for R grants.

**New Investigator vs. Early Stage Investigator**

It’s important that you understand the difference between a **new investigator** and an **early stage investigator** because you will mark that designation on your NIH and eRA profiles.

A **new investigator** is someone who has not been a PI on a significant research project (such as an R01), but may have held small research grants (such as an R03, R21, K award, or fellowship). You could have been an F32 or a T32 trainee, for example; you just can’t have performed PI activities. That means you’re new.
You can also be an *early stage investigator*, which is within ten years of your doctorate for completing your residency. These must be defined on your eRA Commons profile. If you aren't familiar with it, I encourage you to do some research.

**New Training Website**

The NIH has relatively new training websites, as shown here, which are really nice.

https://researchtraining.nih.gov/

They used to be very, very cumbersome and difficult to use. If you go to the website, you'll see Career Development; that's your focus. There's also a *Research Training Kiosk*, which are the F32 and T32 NRSA types of grants. Many of you may have been involved in a T32 training program.

**The Kiosks**

There is a *Fellowship Kiosk*, which are the F32 grants. This training-related kiosk relates to the Pioneer and Early Development Awards I discussed earlier.

Then, there is a *Diversity Kiosk*. Click on Career Development, and you will see a list (not complete) of each of the awards that I’m talking about. You can click on each one, and see what the current funding opportunities are. That's very beneficial: otherwise, you would have to look them up individually. Most of the K01s, K08s, K23s, and K25s have what is called a
development award to promote diversity. I won’t go into that too much, but the NIH is very interested in promoting diversity. If you’re an underrepresented minority, African American, Hispanic, or one of the other definitions, you could apply for one of these.

The nice thing about this website is you can click on the funding opportunities for all K01s in all Institutes, and each one will be listed with all the requirements specified.

It’s important to realize that the K01s are unsolicited, meaning they are announced using Parent Announcements, which are broad funding opportunities that allow applicants to submit their own research ideas. There are also Request for Applications based on a narrowly defined area of research targeted by a specific Institute, in which they want to develop the workforce. All of these have Parent Announcements, and most offer a diversity component.

Go through the ones that you think you’d be most interested in and review the funding opportunities available.

The K Kiosk

For example, if you look at the details of the K99/R00 inside the Career Development Kiosk, it shows you the specific program details and other useful information.
You can see all NIH Policy Notices that affect this activity code listed at the bottom. These come out frequently and detail things such as:

- various program policies that have changed,
- changes to definitions,
- new information requirements,
- changes in dates of submission.

It's really important to keep track of these changes.

To the right are the NIH Funding Opportunity Announcements. Listed first is the NIH Pathway to Independence Award Parent Announcements, one for clinical trials and the other for bench or basic research. The NIH is making more and more clear which awards require or do not require an actual clinical trial, which is important.

As I mentioned at the beginning of the session, you should contact the Institute that you're most interested in applying to. In this particular case, the award is the Mentored Clinical
Research Scientist Development Award (the K08) and its Parent Announcement. It is very, very important that you read every single announcement regarding your grant. **PLEASE DON'T IGNORE THEM!**

You can also see, on the left-hand side, the Institute’s staff contacts. In this case, it's the NCI. On the left, you'll see the name of the program, Program Officer, and grants management contact.

If you are an NCI researcher doing patient-oriented cancer research and you want to apply for a K08, you would contact Susan Lim, PhD. It gives her email, but not a phone number. You can find her number on the NCI website. A lot of people say, "Oh, forget it. NIH never answers their phone. They never answer emails." That's absolutely false! I've called them many times and could always reach the person within a day. They want to help you. Once you've reached them, you can say, "I'm an investigator at so and so university. I have this interest in the K08 for the NCI. I'd like to talk to you about my idea." He or she will say, “Send me your Specific Aims or Training document. I'll see if it's appropriate for what I’m looking for. “

Here is a slide up that I made some years ago, which is really helpful in providing a large-scale view of all grants and how they progress throughout your career.
The ones in orange underneath “Postdoc or Residency,” are the early investigator K99, K22, K01, K08, K23, and K25 grants.

To the right of that, for middle and senior investigators, are the Mid-Career and Senior Scientist Awards as well as the Independent Scientist Awards. In the yellow are the F grants. For pre-doctoral the F30 or F31 can be used, and for postdocs you have the F32. T32s are available for both.

**The goal of the K01 is for you to become an independent investigator.** Keep in mind that, when applying for a K01, your goal is twofold: to gain knowledge in a specific area in which you are deficient, and have a plan to write an R01 during the last years of your K. This is what the NIH is looking for, so make sure to emphasize these in your writing.

With that in mind, the R03, R21, and R01 grants, shown in the lavender box, are the Research Grants that you should aim for. You could have already written a smaller R03 or R21 grant, but your goal is to write a research project like the R01. During the middle and senior years of career, there are cooperative grants such as the U-series, small business innovative research, clinical trial, and R grants. There are also program project grants that you can work on with
other investigators or other institutions. Your focus now is the mentored K awards, as you are in the postdoc, residency, or very early investigator phase.

**NIH RePORTER**

The other thing that you must do if you're an investigator is to know how to use NIH RePORTER. This is an extremely valuable tool for anybody writing a grant, particularly so when writing a K.
In this example, I typed in congestive heart failure treatment (let's say I'm a PI going for a K23 or a K08). The second red arrow is the activity code. If you click on it, you get a very long list and categories of activity codes. Click Uncheck all, and then check the activity codes that you want. In this case, I checked Research Career Awards. Then, I hit “Submit Query” and I get this.

The list is now 11 grants. These are the K award grants focused on congestive heart failure treatment. In the first list it shows K08, K99, K23, and so forth, in addition to the grant title, the PI name, their location, fiscal year, et cetera.

In any one of the lists, you can click on a specific area and get a specific grant with the Abstract.
The Abstract also includes the Public Health Relevance Statement, which is your Project Narrative; you should pay attention to this because this is what goes to Congress who determines funding.

It also illustrates something very important: how to write, in lay language, a very succinct Project Narrative statement about your research. This needs to be in lay language because this will be available to anybody in the world; anybody with a computer can look this up. It needs to be extremely well written, but also give a sense of what the research is about.

The big difference between a K and an R is that a K is research training. The work that you’re doing, even though it is original research with high impact and will give us an answer, is also giving you skills in areas that you are deficient in (as I’ve mentioned). It is really important that you know who else is doing the same type of work in a K environment. You might be very surprised at some of the things you find.
Submission Dates

Submission dates for new K applications are February, June, or October 12th. Reviews are done several months later, with a start date of about a year later.

<table>
<thead>
<tr>
<th>New Applications Due Dates</th>
<th>Resubmission, Renewal, Revision Due Dates</th>
<th>Review</th>
<th>Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 12</td>
<td>March 12</td>
<td>June-July</td>
<td>Sept or Dec</td>
</tr>
<tr>
<td>June 12</td>
<td>July 12</td>
<td>Oct-Nov</td>
<td>April</td>
</tr>
<tr>
<td>October 12</td>
<td>November 12</td>
<td>Feb-March</td>
<td>July</td>
</tr>
</tbody>
</table>

**TIP:** Be careful and pay close attention to the submission dates for new vs. renewal, resubmission, and revisions. I've actually had an investigator miss the deadline because she looked at the wrong list, which was a huge disaster.

Before you even consider writing a K award, you should enlist a mentor because most Career Development Awards require collaboration between you and a mentor. You can have more than one mentor, or you can have a co-mentor. It’s really important that you coordinate this first; you have to be very clear about your development plans for your career and progression. You will also want to put together a review committee or mentoring group to review the application before you send it in.

**Tips Before Writing**

Before we get into the actual writing of the application, here is a list of problems encountered in a sampling of 66 grants.
The takeaway from this is: be very modest about what you're going to accomplish.

Another helpful tool to review before writing is knowing what the reviewers use in their evaluation. When the peer reviewers look at your application, they have these instructions:

<table>
<thead>
<tr>
<th>Review Problem</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals overstated, overly ambitious, unrealistic</td>
<td>45</td>
</tr>
<tr>
<td>Poorly focused, inadequately conceptualized</td>
<td>38</td>
</tr>
<tr>
<td>Hypotheses not clearly articulated</td>
<td>50</td>
</tr>
</tbody>
</table>

Describe the qualities and potential of the candidate with reference to:

1. Potential for conducting independent productive research
2. Evidence of originality
3. Adequacy of scientific background
4. Quality of research endeavors/publications to date
5. Commitment to health-oriented research
6. Need for further research experience and training

The publications here are very important. I can’t advise you on the “magic number” of first, second, or third author publications you should have, but it is important to have some publications that illustrate your accomplishments up to that point.
APPLICATION CONTENTS

There are several elements to the K, but I'm going to concentrate on the Candidate Information & Career Development Plan and Research Plan sections. It is really, really important that you understand what goes into each of them. These used to be separated into individual sections, but are now consolidated into one.

<table>
<thead>
<tr>
<th>Section</th>
<th>Material Requested</th>
</tr>
</thead>
</table>
| Candidate Information & Career Development Plan | Candidate background  
Career Goals and Objectives  
Career Development & Training Activities |
| Research Plan                    | Specific Aims + Research Strategy                                                 |
| Statements of Support            | Statements by Mentor, Co-Mentor, Consultants                                      |
| Environment and Institutional Commitment to Candidate | Description of Institutional Environment  
Institutional Commitment to Candidates Research Career Development |
| Letters of Reference             | 3-5 reference letters not from the Mentor/Co-Mentor  
From established scientists (referees) that address candidate’s qualifications, training, interests and potential for becoming an independent scientist |

This is the SF424 PHS 398 Career Development Award Supplement Form that hopefully your university will help you with and the required attachments.
You will upload your Candidate Section and Goals using this form, as well as your Research Plan, which includes your Specific Aims, Research Strategy, and your RCR training. Then there are the sections for your mentor statements and letters.

The Responsible Conduct of Research (RCR) is a one-page attachment, outside of the 12 pages that I mentioned, and it's very important that you know how to fulfill this training requirement. Your K award will be turned down or returned if it's not completed. You must include five instructional components:
1. Format of instruction
2. Subject matter
3. Faculty participation
4. Duration of instruction
5. Frequency of instruction

Responsible conduct of research is every university's responsibility and the responsibility of every researcher.

**Candidate Section**

Let's focus on the red highlighted material. One attachment will detail your background, goals and objectives, and training activities.

<table>
<thead>
<tr>
<th>2. Career Award Candidate Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate's Background</td>
</tr>
<tr>
<td>Career Goals and Objectives</td>
</tr>
<tr>
<td>Career Development/Training Activities During Award Period</td>
</tr>
</tbody>
</table>

It's really, really important that you understand the difference between these three things: Candidate’s Background, Career Goals and Objectives, and Career Development/Training Activities During Award Period. I have read so many K awards in which the investigator just got confused: for example, putting background under objectives, objectives under background, and training activities under goals. You need to make sure these are separate topics.

Let me break them down for you.

**Background**

The key points to keep in mind when writing this section:

1. Detail your professional responsibilities and their relation to proposed K activities.
2. Your prior training and how it relates to your objectives and long-term plans.
3. Your previous research efforts, including any publications, prior research interests, and experience (not detailed in Biosketch)

4. Trajectory to an independent investigator

5. You must commit at least nine person-months (75% effort) to the career development program and related career development activities

The Background section of your plan should include your professional responsibilities in relation to your proposed K activities. You should answer the following questions:

- What are you doing now as a postdoctoral fellow in a lab?
- What relationship does the research work you’re doing have to your proposed career development activities?
- What prior training have you been exposed to?
- How does that training relate to your objectives?

What the NIH is looking for is a pathway to independence. That pathway goes from college, to graduate school, to postdoctoral fellowship, to research efforts, to publications, and interests/experiences. These things are not necessarily detailed in your Biosketch.

Your Background should also include what you envision your trajectory path will be to become an independent investigator. Then, as I mentioned you need to devote nine person-months, or 75% effort, to the program. Make sure to note that your mentor is well aware of these requirements, and explain how you’re going to accomplish them in conjunction with your current activities.

Objectives

The key points to keep in mind when writing this section:

1. How does the award fit into past and future research career development?
2. If there are consistent themes or issues that have guided previous work, make them clear. If your work has changed direction, give the reasons.
3. It is important to justify the award and how it will enable you to develop or expand your research career. Include a timeline and plan to apply for subsequent R grant support.
Now, let's discuss the Objective portion. These are not your Specific Aims. Rather, these are your Goals and Objectives for your Training Plan. How does the award fit into your past and future research? How does it all fit together? You should create an outline if there are consistent themes that have guided you or rationales for any changes in direction.

It's important to justify the award and how it will enable you to develop into an independent investigator. Remember to include a timeline and plan for subsequent submission of an R grant application.

Your Goals and Objectives should:

- Show a logical progression from prior research and training experiences to the training and research for the award period and on into independent investigator.
- Justify the need for further career development to become an independent investigator.
- Utilize the relevant educational and research resources of your institution.

It is important for the NIH to understand that you have access to all necessary resources.

A really critical point I want to make (and will mention more than once) is: **Be careful not to oversell yourself!** You don’t want the reviewers thinking to themselves, “Well, you don’t need a K award obviously. You got everything going for you. You can write an R grant.” It's very, very, very important that you mention what areas you're deficient in.

Here is a great example of wording that the NIH would like to see:

“In the past five years, I have made progress in developing my clinical research skills, but there are three critical areas in which I require additional training, mentoring, and experience: (1) multi-disciplinary collaboration with clinical and basic scientists, (2) the design and implementation of prospective study design with involvement in the IPFnet, and (3) advanced study design and biostatistical methodology. In the following section, I present a detailed career development plan designed to enable me to acquire the additional training and mentored research experience I need to address these deficiencies and compete successfully for R01 funding, thereby achieving independence as a clinical investigator.”
You can see how this highlights the three key elements I’ve been discussing:

- Identifies specific areas of additional training
- Specifies how you will address those deficiencies
- Plans to apply for an R01 in the future (if you have a particular one in mind, state it!).

Let’s now discuss the final section.

**Training Activities**

This section calls for an extensive amount of detail. You want to describe the new or enhanced research skills and knowledge that you will acquire. Because these are mentored, you want to describe the proposed structured activities (coursework, techniques, didactic training, professional skills training, teaching, mentoring, writing, etc.). For example, you could say:

- “I’m going to present a poster or presentation in a professional organization twice a year.”
- “I’m going to teach these classes.”
- “I’m going to take these various courses.”

**The NIH wants as many details as possible.** They want to know which specific courses you’re going to take, who teaches them, how often they’re offered, and how they fit into the training plan. Discuss each activity, what percentage of time by year, and how the activity relates to the research and the career development plan.

Here is a great example of what I’m recommending. This form is from an actual K08. This shows numerous training activities: workshops, courses, conduct of research and ethics, grantsmanship, career development, and conference attendance. It also shows the proposed percentage of effort.
It's a great idea to relate these activities to what their proposed Specific Aims are. Specific Aims are scientific aims, but they are giving you skills that you're going to need. You may want to relate this career development activity to what research you're doing. You could say, for example, “Aim one will provide me the opportunity to understand the structure of a clinical trial.” It's important that you don't separate those two sections of the grant.

I've seen very successful K grants have these kinds of tables in it. Even though you only have 12 pages for both sections, it's important that you start out with a very specific viewpoint of what you're going to present to the NIH.

**Mentor/Co-Mentor Statement**

There's also a mentor/co-mentor statement, which should be written by them. These are the five criteria:

1. plans for your training and research career development
2. source of anticipated support for the research
3. extent of supervision/mentoring
4. anticipated teaching load
5. overall plan for transitioning you from mentor to independence.

It is critical to state their previous experience as a mentor. In this section, the mentor must specify how many trainees they've had in the last five years and detail how many went on to independence. It's almost like writing a T32 grant, where you provide a table with the names of...
the individuals trained, how long the training was for, what the areas of research were, and their outcome. **So, it's important for you to take this into consideration when choosing a mentor.**

**Letters**

There are letters that you need to get from principal investigators you've worked with; they will be uploaded via the eRA Commons. It's not part of the grant but is extremely important. Be sure to develop effective working relationships with investigators that will provide you a reference.

It's important that they write very specifically why they think you have the potential to develop independence. They should be familiar with your qualifications. With that in mind, you should offer to send them your updated Biosketch, reprints of the papers that you've published, and maybe a draft of your award.

They may ask you to write the letter. Understand that trying to write a hyperbole with no substance is a deal killer for the NIH; they don't want to read that stuff. The best relationship or PI letters are very specific about why they think you will make a great independent investigator. This can be highlighted by detailing research you’ve done and insights you’ve had.
SPECIFIC AIMS AND RESEARCH STRATEGY

Let’s talk a little bit about your Specific Aims and Research Strategy. These will also apply to the R grant, but please remember this application is for research training. You're doing work that will have high significance (hopefully some Innovation) and a high impact on the field, but it is training you in areas that you're deficient in. It's important that you keep that in mind, as well as tying your training plan to the research you're doing.

Outline what you intend to accomplish and why it is worth funding:

1. State concisely the goals of the proposed research and summarize the expected outcome(s), including the impact that the results of the proposed research will exert on the research field(s) involved.
2. List succinctly the specific objectives of the research proposed, e.g.,
   - 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 in the field
   - Develop a new technology

I've highlighted key wording that almost everybody misses it. You MUST include the expected outcomes and the impact of the proposed research results on the field of study.

What are you doing in your objectives? For example, are you testing your hypothesis? Every research puts forth a test and tests the hypothesis. You may be creating a novel design, solving a specific problem, challenging a paradigm or clinical practice, addressing a barrier to progress in the field, or developing new technology. You could be doing all those things, but these are the words that the NIH uses and it's very important that you keep your head aimed at that when you're writing.

Great questions to ask yourself are:
• What specific problem am I studying—what gap in knowledge or unmet medical need am I filling?
• How am I going to fill that gap/need through my research?
• What do I expect to find?
• How will my research impact the field going forward, i.e., what new information or insights will it give other researchers to move forward? **You have to keep this in mind when you're writing: this paradigm will also apply to your future R grant.**

The Aims have a very specific structure.

The **first paragraph** defines the problem from the need. This is a short background, leading up to the stated problem and knowledge gap.

The **second paragraph** is the solution to your stated problem (proposing a hypothesis).

The **third paragraph** states the Specific Aims that address the critical needs.

The **fourth paragraph** is the payoff to the NIH. **What do you expect to find? Does it address an NIH need?**

If you are applying for a K award and targeting a high research priority using a Request for Application (RFA) opportunity, be sure to address the Institute’s need for this research. If you are applying using a broad funding announcement, such as a Parent Announcement, you must make the need very, very clear. You will need to discuss what areas you’re studying that might be interesting or an item that the NIH wants more information on (you can find that out by looking at each of the Institute’s strategies). For example, the NCI has a list of provocative questions that they want answered.

Finally, you need to discuss how your study will exert and sustain influence. If it won’t work, it has no impact even if it has a very high significance and is important to study. You should address the immediate problem and your longer-term goals. In a K award, your longer-term goal is to write an R grant and move in this area.
Paragraph 1

The basis for your project is how are you going to fill that gap or need. You need to hook your reader in the first sentence. You need to say what is known, what is unknown, and identify gaps in diagnosing or treating the disease. You don’t want to say things like “Little research has been done,” “There’s need for additional work,” or “Few studies have been made.” I hate reading this, and the NIH hates it too.

Also, don’t give the NIH some obvious statistical jargon from the Centers for Disease Control. For example, don’t say, “Type II diabetes affects more than 3% of the U.S. population” or “Lung cancer is a leading cause of death.” They’re not interested in that. As I’ve repeatedly said during this session, what they are interested in is what gap in knowledge are you filling.

What they might want to hear, for example, is “Although overall rates of cigarette smoking in the U.S. have decreased in the last 20 years, smoking rates have actually increased among low-income women of childbearing age in the past ten years.” Wow! I didn’t know that. This is the area that they’re studying, so it is an area of critical need. Be very clear in the beginning as to what you’re studying.

Paragraph 2

Your hypothesis statement should address a few key points.

- It must be compatible with all known facts and evidence.
- It must be specific.
- It must be testable (i.e., there’s at least two outcomes).
- Your Aims will test it.

Paragraph 3

Keep in mind that:

- Specific Aims that are hypothesis-based to address the problem and fill the gap.
- Aims that are SPECIFIC, measurable, and do-able in the timeframe of the grant
Remember, this is a K award so it will involve taking classes, going to medical conferences, and conducting presentations, in addition to your research. Your research is important, but the NIH is going to look at it in the context of training.

Whenever you write specific aims, don't use language like:

- To study the effects of...
- To explore the reasons for...
- To better understand the effects of....
- To investigate the causes of....
- To research why...

This is something the NIH hates. I hate it, as well, because it doesn't tell you anything. It’s lazy writing. It is much better to say something to the effect of, “I’m measuring levels of calcium and magnesium in the wound microenvironment” or “I’m determining the normal range of fetal-to-adult T cells in the umbilical cord blood of the full-term neonate.” Those are measurable and specific objectives.

**Paragraph 4**

Here you will want to focus on:

- What are my expected outcomes?
- What is the probability my study will be successful and exert a powerful sustained influence on the field(s) specifically?
- Expected outcomes must be specific and credible; it’s the return on investment for NIH
- Do not write in the future tense
- How will these stated outcomes fill the identified need and thereby advance research (and the mission of the agency, if possible)?
In this last paragraph, you will elaborate on your expected outcomes:

1. What do I expect to find?
2. What is the probability the study will exert a powerful sustained influence in the field?
3. What impact will it have?
4. How will these stated outcomes fill the identified need and thereby advance the research and the mission of the agency, if possible?

A lot of Specific Aims pages don't describe how their research is going to push the field forward, which is so important for the NIH to see.
SIGNIFICANCE

The significance section of this grant is something that confuses people, so here are some thoughts to help clarify things.

- What is the importance of the problem or critical barrier to progress in the field that the proposed project addresses?
- How will my work improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields?
- How will the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field be changed if the proposed Aims are achieved?

In a significance section, why is the research important? Make sure it is a very compelling case. What review of unpublished and published work conclusions match your own? How is your research going to fill the gaps that you've stated; that you're aware of those opportunities, gaps, and roadblocks and tie it to the mission of the NIH if possible. That's why you should check the Institute website for the research priorities in any Program Announcements or Request for Applications. Sometimes you'll uncover areas of research that would align with yours, and that's important for you to know.

Rigor and Responsibilities

The NIH now has some new requirements called rigor and responsibility. They address the scientific premise, which includes the strengths and weaknesses of published research and/or preliminary data that support your application.
INNOVATION

The Innovation section is one of the hardest parts of a grant. Here you should address how novel or original your proposed research is. It is a slippery slope in a K award because you're new and you don't want to propose something that's highly, highly innovative, but the NIH wants to know that you're going to break new ground. It's important that you look critically at what the innovation is. At least 75% of the time, this section is poorly written because innovation is something that few investigators truly understand.

**These are some things that you should consider when proposing something new that's innovative:**

1. How is my work being done now (i.e., what existing strategies are being used to address the problem)?
2. What limitations do these methods have, and why have they not worked?
3. What are the advantages of my approach and what advances will be possible for future research that would have not been possible with the old methods?
APPROACH

The Approach section is probably the longest part of your Research Strategy. You should include all four concepts listed below:

1. Describe the overall **strategy, methodology, and analyses** to be used to accomplish the Specific Aims of the project.

2. How will data be **collected, analyzed, and interpreted** as well as any resource sharing plans as appropriate?

3. Discuss **potential problems, alternative strategies, and benchmarks** for success anticipated to achieve the Aims.

4. If the project is in the early stages of development, describe any strategy to **establish feasibility**, and address the management of any high-risk aspects of the proposed work.

Be sure to emphasize the items in bold – these are the points you really want to drive home.

You probably won’t have room to put in benchmarks for success, but it's important to keep those in mind. **How are you going to know you've gotten what you want?** It's important, if you have any areas that you're not familiar with, to bring on collaborators from other institutions. These individuals could also write your letters. They might be a co-mentor from another lab who can help you with a new method that you've never used. They could be an investigator from another institution in a different part of the country who will help analyze your MRI scans for some specific aspect.

It’s very important that you tell the NIH you’ve got lots of people underneath you that are supporting you in any high-risk aspects of the work.
RIGOR AND REPRODUCIBILITY

This is a new requirement for all K and R grants. To summarize,

- The expectation now is that the NIH is funding rigorous science, and increasing transparency and scientific rigor.
- A lot of the details that were previously overlooked are now asked for.
- It does not require a new section of the grant.

You want to highlight three concepts:

1. Describe the design and methods, in addition to how they will achieve robust and unbiased results.
2. Explain how variables, such as sex, are factored into research design/analysis in humans and animals.
3. Strong justification from the literature, preliminary data, or other relevant considerations must be provided for applications that propose to study only one sex.

If you're studying humans, you don't have to worry about any of this.

These are the four sections.

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<thead>
<tr>
<th>Key Area</th>
<th>Application Instructions</th>
<th>Review Language</th>
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<tbody>
<tr>
<td>Scientific Premise</td>
<td>Research Strategy: Significance</td>
<td>Scored Review Criterion: Significance</td>
</tr>
<tr>
<td>Consideration of Relevant Biological Variables, such as sex</td>
<td>Research Strategy: Approach</td>
<td>Scored Review Criterion: Approach</td>
</tr>
<tr>
<td>Authentication of Key Biological and/or Chemical Resources</td>
<td>Other Research Plan Attachment</td>
<td>Unscored Additional Review Consideration: Attachment</td>
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The first three aspects are scored under your Research Strategy. In other words, if you don't have them in there, you won't get a good score. You may have a great program and a really great academic record, but to get the best scores you need to show reviewers you can establish a research career. That's going to be evident from the work that you've done in the past, your publications, your research, the need that you've stated, and your training plan in addition to the letters in your Mentor Statement.
SUMMARY

Your Career Development plan is just as important as your Research Plan; they should not be independent. You want to explain how the K will be a vital step towards your ultimate career goal and move you toward scientific independence. Therefore, you want to specify training and courses you'll need to participate and how often you'll meet with consultants; how all that stuff will help you reach independence. NIH wants to know “How is this person going to get to research independence?” They will also look very closely at your Research Plan, your Aims, and your Strategy. They'll evaluate whether it's appropriate for your level of experience and allows you to develop the skills and knowledge you need for further career advancement. Be careful not to propose too much. You're proposing Aims that will provide new scientific information for the field but will also give you skills. You need to achieve your objectives in the time of your request (four or five years). It will be a deal killer if you have too much information, or too many Aims to accomplish in that period. Your mentor should be able to guide you on that. Here’s a nice summary graphic of the criteria on which you will be judged.

If you have any questions, you can reach me at this email: medcomconsul@gmail.com. I’d love to take questions now.
**QUESTION & ANSWERS:**

**Q. Do all NIH Institutes accept Career Development Awards and how many Institutes are there?**

A. I believe there are 27. Every Institute is different in what they offer. As I mentioned, the K01, K08, K23, and K99 are offered by almost every Institute; the K25 is not, but it is offered by many of them. Two of them are offered only by NCI. The best thing to do is review the K Kiosk to look at what offers there are at the time.

**Q. Does AHRQ have any requirements or stipulations that differ from the material presented?**

A. I'm not too familiar with that particular agency, because it's not formally part of the NIH. In reviewing their website, I see that they do offer the K08 but you do have to be a clinical scientist, and they don’t offer K01 PHDs.

**Q. Among 12 pages, how many pages for Research Strategy and how many pages for Career Development Plan do you recommend when applying for a K99 grant?**

A. The NIH doesn’t make those recommendations, but I believe your Career Development Plan should be four or five pages, and the rest should be devoted to the Research Plan. The majority of the Research Plan, of course, should be the Strategy section, which describes how you’re going to accomplish each of your Aims. The Significance and Innovation should only be a page and a half at the very most.

The most important thing you can do is outline your grant **first**. I have seen many investigators realize, three-quarters of the way through writing the grant, that they only have one or one-and-a-half pages left. They start truncating the material, which is a big mistake. If you write succinctly and clearly and avoid repetition (90% of the grants I read don’t do this), then you will make it in 12 pages. You can fit a lot of material on one page. Tables and figures take up a lot of space, so use those sparingly. If you find that
your grant is highly complex and requires tons and tons of explanation and research information, you're probably putting way too much in there.

I've seen these two sections covered in 10 succinctly written pages. Twelve pages doesn't mean that you must fill 12 pages, and I would love it if you filled out only 10 and a half.

**Q. What happens to the K award if the awardee moves to a different institution?**

A. Good question. Most Ks can travel to another institution, but cannot move from one PI to another. Of course, the NIH will require you to fill out paperwork. The justification must be very strong. For example:

- the lab you're working in suddenly runs out of funding,
- the lab isn't doing any more work,
- your mentor dies,
- your mentor goes to another institution.

Your request will be denied for weak reasons, such as:

- I like the weather better at the new institution
- I just really want to go there

As I mentioned, there is an exception: moving is fairly common for the K99. A person does their K99 work at one institution and is then offered a job at another institution.

**Q. Is it a good idea to reference your training objectives somewhere in the Specific Aims page?**

A. I mentioned this a little bit. You can, but the more common approach is referencing the Specific Aims in the training objectives. I've seen them cross-reference Specific Aims to those training objectives. Let’s say one of your training objectives is to gain a more complete understanding of all aspects of a Phase 1 clinical trial. Your first Specific Aim is to conduct a Phase 1 clinical trial with a certain number of patients in a certain area. It may be an oversimplification, but you could write it in your Aims.
Q. When considering a K award while in postdoc with intentions of pursuing an academic position outside of your current institution, what are the recommendations around when to prepare the award and when to submit before or after starting an academic position at other institutions?

A. Well, I'm a little unclear on that. If you've secured a position at another institution already, it's not clear to me why you would apply for a K award. In other words, the only aspect of those that's clear is the K99/R00. They are for postdocs who don't have a position other than a postdoctoral, T32 trainee, or e F32 trainee trying to obtain independence. They want to get a tenure-track, assistant professor position and need additional skills to do that.

Q. How important is the preliminary data section in the Research Plan?

A. It's important in research grants. In fact, the R20, R25, and R01 require that you've already put together a fair amount of research in your Aims area. For the K award, it isn't as critical. Obviously, you've been doing research to some extent. If you're a brand-new postdoc, you probably won't apply for a K award yet. You need a year or two of research as a T32 trainee, F32 trainee, or some other funded position.

If you're doing research in areas you've been working previously, then obviously you will have some preliminary data and publications. It's important for the NIH to review what you've done, mostly to evaluate your track record thus far. What they're looking for is your potential as an independent investigator, how original your research is, and if it is appropriate for your level.

Q. What if, after the training, I learn that what I wrote in my Innovation section is wrong? Are there any commitments to do the Innovation as stated, just because it was on the application?

A. If you suddenly change the whole shift of how you're doing your research and what you're looking at, that might be of concern. But it's very common for people doing research to suddenly realize, "This is not going to be as innovative. This is not going to work." As long as the research is basically the same and is giving you the skills that you need to become an independent investigator, they won't shut your funding down.