Grant Writing 101

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Office of Intramural TRAINING & EDUCATION
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What We Will Cover Today

- Understanding the process
- Understanding peer review
- Thoughts on writing your application
- Thoughts on responding to critiques

What We Will NOT Cover

- Advice specific to you and your personal situation

Take Home Message

You will decrease your stress level and have more time to focus on science if you take the time to understand the grant writing process -- from first idea to final outcome

Finding Funding Opportunities

- Search on-line databases
- Talk with mentors
- Talk with representatives of relevant funding agencies at scientific meetings
- Talk with your grad/postdoc office, training office or institutional grant office (Office of Sponsored Research)
  - Some grants have an institutional nomination process

Funding Opportunity Announcement

- A publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds.
- May be known as a:
  - program announcement (PA)
  - request for application (RFA)
  - notice of funding availability
  - solicitation

PAs *vs*. RFAs

- Program Announcement (PA)
  - Non-specific, investigator-initiated; any topic within the mission of the organization/agency
  - No set-aside budget
  - Standard receipt dates
  - Standard review criteria for mechanism of application
- Request for Application (RFA)
  - Addresses a well defined area of research
  - May have a set-aside budget
  - Often submitted on a special, one-time receipt date
  - Often special eligibility and/or review criteria
  - Often special application format and/or submission instructions

Be Sure You Are Eligible

- Pay attention to two types of information
  - Institutional eligibility (where you are matters)
  - Individual eligibility (who you are matters)
- Clarify any issues with relevant contacts at the funding agency
- Just because you are eligible to apply for a specific grant does not mean you should apply for it then. Consider:
  - Is this the right time for me (and my group)?
  - Can I put together a competitive application?

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Understanding the NIH

Warnings and Disclaimers Up-Front

- Each NIH Institute has a different mission and a different set of policies and procedures. Grant mechanisms, rules, and support for various funding mechanisms may differ
- Everyone has their own opinion – ask many knowledgeable people and spend A LOT of time on the OER website

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An Overview of the Process

Applicant Initiates Research Idea

Conducts Research

University Submits Application

Electronic Submission

GRANTS.GOV℠

National Institutes of Health

Assign to Institute and Study Section

center for scientific review

Peer Review

1st NIH Study Section 1946

Review of Scientific Merit

Institute
(24 with funding authority)

Evaluate Relevance

Leaders in the biological and medical sciences, education, health care, and public affairs.

Advisory Council

Recommend Action

Institute Director

Takes Action

Allocation of Funds

Take a Deeper Dive

- Understand and probe the mission of relevant Institutes
- Understand extramural NIH and the grant review process
- Look at what is funded in your research area

Explore Relevant ICs

- Your goal is to find the NIH IC(s) most likely to care about what you do
- Links to IC web pages at www.nih.gov/icd/
- Following FUNDING tab to find information on specific research programs
  - Read about general areas of emphasis
  - Find Funding Opportunity Announcements (FOAs)
  - Find relevant contacts and reach out by email
- Remember: Your research may be of interest to more than one Institute

Understand Extramural

www.grants.nih.gov

The Center For Scientific Review www.csr.nih.gov

- Central receipt point for all NIH grant applications
- Receipt and Referral Branch is responsible for directing your application to the appropriate study section and Institute for funding consideration
- Also manages ~200 Study Sections
  - Some grants are reviewed by study sections organized by an NIH Institute

Important Extramural Contacts

- Program Officer (PO)
  - Institute Staff who manage a portfolio of awarded grants in a particular scientific discipline or funding area
  - Speaks with potential applicants about eligibility, fit with the IC, etc.
  - Monitors scientific progress made on grant
- Scientific Review Officer (SRO)
  - CSR or Institute Staff
  - Organizes and manages study section
  - Liaison between applicant and reviewers
  - Prepares summary statements
- Grants Management Officer

Know What the NIH Funds

- Use the RePORTER at http://report.nih.gov/index.aspx

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QUERY | BROWSE NIH BETA NEW

SUBMIT QUERY | CLEAR QUERY

NIH (non) ARRA Selection: SELECT

Text Search (*Logic*):

And Or Advanced

Search in

Projects Publications Projects & Publications

Limit to

Project Title Project Terms Project Abstracts

Limit Publication search to

Start Year 2012 *End Year* 2013

Project Number:
Format: 5R01CA012345-04
Use '%' for wildcard, e.g. %R21%
Enter multiple project numbers
OR
1 R01 CA 811099 01 A1S1

Principal Investigator (PI) / Project Leader:
(Last Name, First Name)
Use '%' for wildcard
Enter several PI/Project Leader names

Organization: LOOKUP
Please enter at least 3 characters to use Lookup.
Contains Begins with Exact

DUNS Number:

Department: SELECT

Educational Institution Type: SELECT

City:
Use '%' for wildcard

Fiscal Year (FY): Active Projects SELECT
Current FY is 2013

NIH Spending Category: SELECT

Agency/Institute/Center: SELECT
Admin Funding

Funding Mechanism: SELECT

Award Type: SELECT

Activity Code: SELECT

Exclude Subprojects:

Multi-PI Only:

Study Section: SELECT
Standing CSR study sections only

FOA:
Format: RFA-IC-09-003 or PA-09-003
Use '%' for wildcard
Funding Opportunities and Notices

Public Health Relevance:

Project Start Date: >=
Format: mm/dd/yyyy
mm/dd/yyyy

Project End Date: <=
Format: mm/dd/yyyy
mm/dd/yyyy

Award Notice Date: >
Format: mm/dd/yyyy
mm/dd/yyyy

Main Types of NIH Grants

- Research Training & Fellowships (T & F series)
- Career Development Awards (K series)
- Research grants (R series)
- Program project/center grants (P series)
- Trans-NIH Programs (Diversity supplements, GWAS studies, NIH Common Fund, etc.)

http://www.grants.nih.gov/grants/funding/funding_program.htm#Trans

NIH Career Development Awards
K Grants

- Support for research-focused career development at various career stages
- For clinicians and basic scientists
- Wide range of specific funding mechanisms
  - currently 14 different funding mechanism (K01-K99)
- Information and links to all relevant pages at the NIH K Kiosk
  - http://grants.nih.gov/training/careerdevelopmentawards.htm

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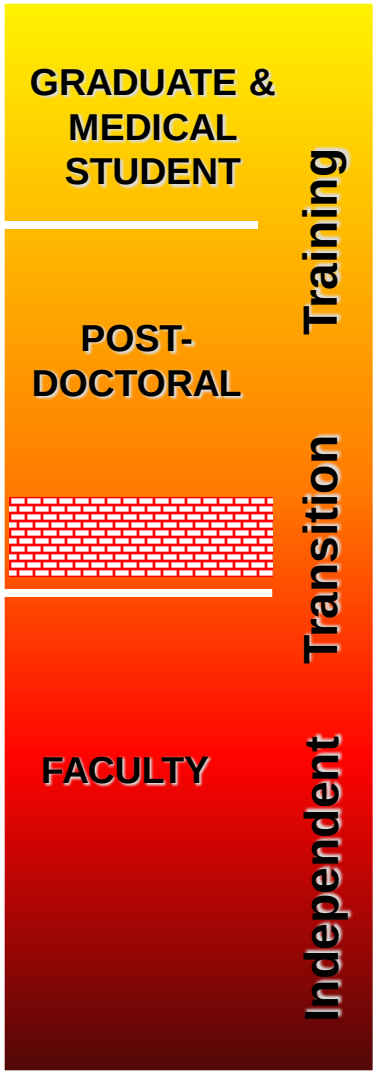
Training and Career Development Awards



Pre-doctoral Fellowships
(NRSA -- F30, F31, T32)

Post-doctoral Fellowships (NRSA -- F32, T32)

K99-R00 Pathway to Independence Award

K22 Career Transition Award

K01 Mentored Research Scientist Development Award
K08 Mentored Clinical Scientist Development Award
K23 Mentored Patient-Oriented K Award
K25 Mentored Quantitative K Award

K02 Independent Scientist Award
K24 Mid-career Award in Patient-Oriented Research

Funding Opportunities

Funding Opportunities (RFAs, PAs) & Notices

Unsolicited Applications (Parent Announcements)

Research Training & Career Development

- Extramural Training Mechanisms
- Intramural
- News
- Career Resources
- Q&A and FAQs

Small Business (SBIR/STTR)

Contract Opportunities

NIH-Wide Initiatives

New and Early Stage Investigators

Stem Cell Information

NIH Common Fund

OppNet (Behavioral & Social Sciences)

Award Data

NIH Reports (RePORT)

Search NIH Awards

K Kiosk - Information about NIH Career Development Awards

- **K-Awards Across Institutes and Centers** (June 1, 2010) - (Excel - 813 KB) - Institute and Center specific information with links to appropriate websites
- **Career Award Wizard** - Helps you select the right career award
- **Visual Guide to NIH Career Development Awards**
  - For individuals with a research doctorate
  - For individuals with a health-professional doctorate
- **Career Award Data and Administrative Information**
  - Funded Career Development Awards
  - Career Award Application Success Rates
- **Career Development Podcasts**
  - Enhance Your Research Capabilities through an Independent Career Award (July 29, 2010) - MP3 (15 min) | Transcript
  - Using Career Development Awards to Achieve Independence (June 21, 2010) - MP3 (12 min) | Transcript

Program	Description
Policies and Notices	Career Award Policy Issues
K01	NIH: Mentored Research Scientist Development Award (Parent K01) (PA-11-190) (See NOT-OD-11-063) NCI: NCI Mentored Research Scientist Development Award to Promote Diversity (K01) (PAR-09-052) NIDDK: NIDDK Mentored Research Scientist Development Award (K01) (PAR-09-060) NIDDK: NIDDK Mentored Research Scientist Development Award (K01) (PAR-12-020)

Study Sections and Peer Review

WATCH!

http://www.youtube.com/watch?v=fBDxI6l4dOA

The Center for Scientific Review (CSR)

- Central receipt point for all grant applications
- CSR assigns applications to NIH Institute/Center as potential funding component
- Also manages ~200 Scientific Review Groups ("Study Sections")
  - Some grants are reviewed by study sections organized by an NIH Institute

How Applications Are Assigned To Institutes and Study Sections

- Based on input from you -- in a cover letter
- Based on past review history of the application (if any)
- Based on the research area
- Depending on the type of application (R01, F32, K series, etc.)

Who Serves on Study Section

- University faculty, NIH intramural investigators, and industry scientists
- SRO works carefully to recruit diverse participants
- Basic/Clinical ranges from 60/40 to 40/60
- Some members are permanent members, serving ~4 years; others are ad hoc members participating for one meeting

Study Sections and Reviewers

- Study sections typically review 70-120 applications
- Applications are assigned a primary and secondary reviewer; most are also assigned one or two readers
- Reviewers are typically assigned 9 - 12 applications to review
- Reviewers write critiques for the applications on which they have primary or secondary responsibility; readers may also provide critiques
- You cannot contact reviewers, before or after review

What Happens at Study Section

- Assigned reviewers state their preliminary scores
- **Primary** reviewer introduces the application; discusses strengths and weaknesses
- **Secondary** reviewers focus on differences & additions
- Other reviewers share their thoughts
- Committee members join the discussion
- Assigned reviewers restate their scores
- All reviewers vote
- All reviewers weigh in on animal usage, human subject concerns, and budgetary issues
- Primary and secondary reviewers amend their written reviews which are submitted to the SRO for processing

What Reviewers Evaluate for Research Grants

- Overall Impact
- "Core" Criteria
  - Significance
  - Investigators
  - Innovation
  - Approach
  - Environment
- Additional Issues (e.g. Human Subjects Protections)

What Reviewers Evaluate for Training and Career Grants

- Overall Impact
- Candidate
- Career Development Plan
- Research Plan
- Mentor(s), Consultant(s), Collaborator(s)
- Environment and Institutional Commitment
- Other criteria include: RCR plans, humans/animals, etc.

The Scoring System

"Old" System	"New" System
Priority Score Range: 100-500	Overall Impact Score Range: 10-90 (integers only)
	Criterion Scores: 1-9 (integers only)

- 1 is still the best
- Overall impact score need not be mathematically related to criterion scores. Reviewers weight the criterion scores as they believe appropriate in assigning overall impact score.

Scoring Guidance

Score	Descriptor	Additional Guidance on Strengths/Weaknesses
1	Exceptional	Exceptionally strong; essentially no weaknesses
2	Outstanding	Extremely strong; negligible weaknesses
3	Excellent	Very strong; only some minor weaknesses
4	Very Good	Strong but numerous minor weaknesses
5	Good	Strong but at least one moderate weakness
6	Satisfactory	Some strengths; some moderate weaknesses
7	Fair	Some strengths but at least one major weakness
8	Marginal	A few strengths; a few major weaknesses
9	Poor	Very few strengths; numerous major weaknesses

What the Summary Statement Looks Like

- Reviewers use a structured template
- Reviewers provide bulleted comments for:
  - Overall strengths & weaknesses
  - Strengths & weaknesses of each core criterion
  - Comments on Other Review Considerations
- Additional comments (“advice” to applicant)
- Goal: increase transparency of review process and to improve feedback provided to applicants.

What about Not Discussed Applications?

- Applications that are not discussed by the review panel:
  - Are generally those in the lower half
  - Do not receive an overall impact score
  - Receive summary statements that include the written critiques and criterion scores from the assigned reviewers but do not include an overall impact score

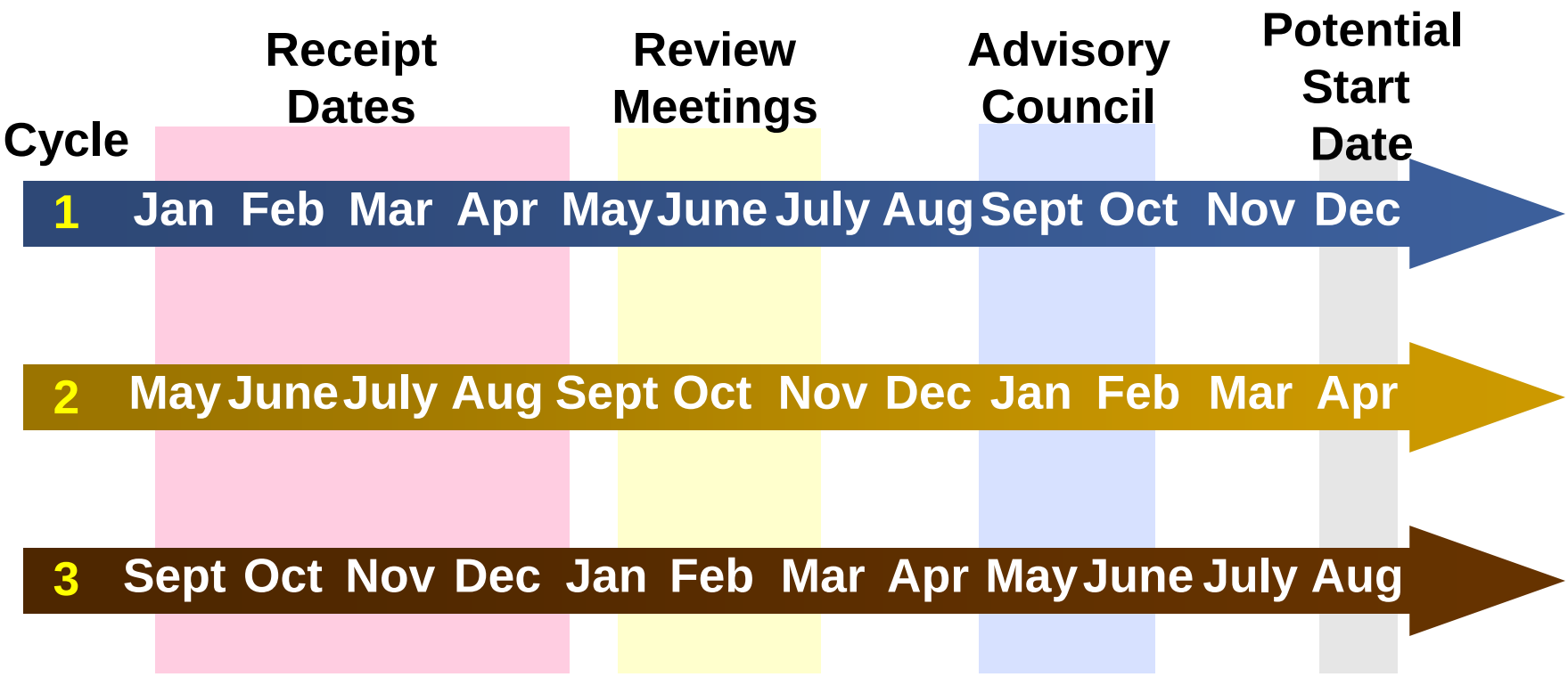
The Review process is a 2 Level System

- 1st Level: Initial Scientific Peer Review
  - Independent, outside reviewers
  - Evaluates the scientific merit and significance
  - Does NOT make funding decisions
- 2nd Level: IC National Advisory Council or Board
  - Evaluates quality of initial peer review
  - Makes recommendations to Institute staff on funding
  - Evaluates program priorities and relevance

The Psychology of Grant Review

- Reviewers are:
  - Over-committed, over-worked and tired
  - Inherently skeptical and critical
  - Often only peripherally interested in your work
- Make their job easier with:
  - Well-organized, clearly written prose
  - Lots of section headings and breaks in the writing
  - Repeat important points at several places in the application
  - Well designed flow diagrams, charts, figures
- And avoid irritating them by:
  - Exceeding page limits, using small fonts and narrow margins
  - Putting information in the wrong section
  - Omitting or mislabeling references/figures
  - Submitting a sloppy application

Be Aware of Timing



Important Early Conversations

- Mentors and trusted advisors
- Extramural Program Officer (PO) to discuss
  - Which grant mechanism fits
  - Possible Institute for funding
  - Thoughts on study section
  - Aims and ideas
- Relevant institutional officials
- Be prepared for all of these conversations
  - You should have NIH Biosketch and Aims page before contacting NIH PO

Getting Started: Administration Issues

- Download and carefully read all instructions and deadlines (Parent FOA, RFA, etc.)
- Make sure you are registered for government internet based application and award systems, particularly eRA Commons
- Talk with lab/department/IC administrators about budgeting, all required approvals, and routing procedures
- Begin all required approvals well in advance of the deadline; 3 months is not unreasonable at the beginning of your career
- Contact collaborators and arrange for letters as needed

Getting Started: Science Issues

- Read the literature broadly - not deeply; save important papers for a deeper read later
- Engage your lab, mentors and collaborators in the brainstorming process
- Find outside experts to talk with - but go prepared
- Begin early to define, organize and plan the content

- NOTE: Early means 6 - 9 months before the deadline

Elements of NIH Research Grants

- Cover Letter
- Title Pages
- Abstract
- Budget with Justifications
- Biosketch(es) of Investigators
- Resources and Facilities
- Introduction (resubmissions/revisions only!)
- Specific Aims (1 page)
- Research Strategy (6-12)
- References
- Human subjects, animals, and other assurances

Excellent Resources for Writing Your Application

- Table of page limits: http://grants.nih.gov/grants/forms_page_limits.htm
- Examples of successful applications from NIAID http://www.niaid.nih.gov/researchfunding/grant/Pages/appsamples.aspx#rpindex

Specific Aims

- Provides an overview of the details - tells what your proposal is about, and how you will get there
  - start with 1 - 2 paragraph general overview
  - then list AIMS, each clearly defined
  - end with a brief statement of what you will learn if successful
- The reader must finish this section convinced that the proposed research is significant and that you have a feasible approach
- The aims should be clearly and concisely stated; many also include sub-aims
- Typically 2 - 4 related aims. Later aims should NOT totally depend on the success of previous aims

Example 1 (AIM 1 of 3)

AIM 1. Study the role of the CFTR-FLN interaction in CFTR folding and ER export: We find that FLN directly associates with residues 1-25 of CFTR and that Ser13 is required for this interaction. We further find that S13F CFTR is abnormally processed when expressed in mammalian cell lines, suggesting that the association with FLN plays a role in the maturation or stability of CFTR. Thus we will:

1A. Complete the biochemical characterization of the CFTR-FLN interaction

1B. Compare the biosynthesis and trafficking of WT and S13F CFTR

1C. Determine the role of FLN in the regulation of CFTR biogenesis and trafficking in FLN-null cells

Example 2 (AIM 1 of 3)

Specific Aim 1: Investigate whether cigarette smoke extract inhibits the cAMP-dependent apical membrane anion conductance in HBE cells in an oxidation-dependent fashion. The cystic fibrosis transmembrane conductance regulator (CFTR) is the principal cAMP-dependent anion channel and is sensitive to oxidation. Therefore, we propose to study the effect of CSE on CFTR. First, we will use short-circuit current measurements in permeabilized HBE cells exposed to various ionic gradients to define the change in apical membrane anion conductance with CSE exposure. Second, we will use fisher rat thyroid cells heterologously expressing CFTR with various cysteine mutations to test the hypothesis that CSE affects chloride conductance through changes in the oxidation state of the CFTR channel.

As You Write, Keep This In Mind

- Your grant application will likely have several types of assigned reviewers:
  - An expert in the field
  - Someone who is smart but knows little about your field
- Therefore, your application must appeal to both audiences
- It is your goal to get people excited about your research
  - Let your enthusiasm for your research be reflected in your proposal.
  - If you are not enthusiastic when writing your proposal, it is unlikely the reviewers will see anything different

Important Point

The specific aims page is your hook

Make it as perfect as possible

Research Strategy Section

- Significance
- Innovation
- Approach
  - Preliminary studies/progress report
  - Experimental design and method

Significance

- You must clearly state the importance of the proposed research
- Write looking both backward and forward
  - How we got “here” and where we need to be
- Important to point out any controversies and discrepancies that your work will address
- Should be appropriately referenced with an honest and balanced discussion of the field

Changes in review were designed to place more focus on **impact** and less on details of approach

Impact combines significance and feasibility

Feasibility = Preliminary Data

- To show that you can do what you say you are going to do
- To generate excitement and enthusiasm for the proposed studies
- To show you are a careful scientist who understands the value of controls and does not over-interpret data
- Typically several figures with clear legends; figures should be large enough for reviewers to easily read
- Do not assume the reviewers will go to look at your publications; give them everything they need to review the grant

Research Strategy - Innovation

- Will this effort shift current research or clinical practice paradigms?
- Is the proposed work new? Creative? Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions(s) to be developed.
- How will the results direct/inform future research?
- Will success improve the “State-of-the-art”, or establish new research directions?
- Remember that faked innovation will get you in trouble, so be clear, but do not “make something of nothing”

Research Approach

- Organized by specific aims, not by techniques
- Include an overview of approaches and the rationale for experiments
- Define controls (positive and negative) for all experimental approaches
- Show you have thought through issues of feasibility, sample size, data analysis, etc.
- Include a discussion of expected outcomes and data interpretation
- Include a discussion of potential problems, and alternate approaches

Strong Research Plans:

- Explicitly state the rationale for the proposed studies
- Never assume reviewers will intrinsically appreciate or understand what you intend
- Use flow diagrams for overview, and for complex experiments and protocols
- Include well-designed, easy to follow tables and figures
- Address priorities if patients, reagents or resources will be limited
- Include a discussion of how the data will be analyzed and interpreted
- Include realistic discussions of pitfalls and provide alternate approaches

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Sections of a K Grant

SECTION	PAGE LIMIT
Introduction to revised application (if resubmission)	1
Specific Aims	1
Candidate Information including: a) Background; b) Career Goals/Objectives; and c) Career Development Plan	12 TOTAL
Research Strategy including: a) Significance; b) Innovation and c) Approach	
Training in the Responsible Conduct of Research	1
Mentoring Plan (when required)	6
Statements by Mentor, Co-Mentors, Consultants, Contributors	6
Description of Institutional Environment	1
Institutional Commitment to Candidate's Research Career Development	1
Biographical Sketch	4

Candidate Background

- Explain where you have been and how it relates to where you are going (Career goals and Objectives)
- Highlight:
  - Your prior training and how it relates to your objectives and long-term career plans
  - Explain why you chose the mentors you chose, the projects you focused on, and the activities you engaged in
  - Detail your professional responsibilities at your current institution and explain how they relate to your proposed K activities
- Clearly explain your path toward becoming an independent investigator
  - If your research focus has changed direction, give the reasons and explain the progression

Career Goals and Objectives

- What do you want to do in your future career
  - In your research
  - And beyond; for example in the areas of teaching, mentoring, field work, clinical work, etc)
- Discuss your plans to apply for subsequent grant support and briefly describe how the K Award will facilitate that process
- It is important to justify the award and how it will enable you to develop or expand your research career

Career Development Plan

- Describe new/enhanced research skills and knowledge you will acquire
- Described new/enhanced professional skills and knowledge you will acquire
- For mentored awards include a clear discussion of your mentor(s); how/when you will interact with them and what each will provide during your training
  - Although some K awards are not mentored awards (ie NIAID K22) a brief explanation of mentoring relationships often strengthens the application
- Discuss each activity, include a percentage of time by year, explain how activity relates to the proposed research and the career development plan

What To Cover In A Career Plan

- Additional technical training, not incremental advances in what you already know
- Didactic training
  - Depends on your educational level and background
  - Traditional and non-traditional ways
- Professional training
  - In anything you will need to be successful as an independent scientist
  - Including communication, mentoring, teaching, management, and leadership skills
- Job Search information
  - Who will help and when
  - Availability of institutional resources

Strong Career Plans:

- Goes beyond the "standard stuff"
  - Standard is lab meetings, journal clubs, attending the obvious National/International meeting
- Are based on your career goals, not someone else's or on a standard institutional template
- Demonstrate that there is a meaningful interaction between the mentor(s) and the mentee
  - Meaningful letters and specifics help
- Involves a mentoring team when appropriate
  - Especially important if you have an inexperienced mentors
  - When research diverges from mentor's expertise
  - When career goals are outside the mentor's expertise
- Show some evidence that you mean what you say

Responsible Conduct of Research

- Limited to 1 page outside of the 12 pages allowed for the main body of your application
- If you fail to include one or your description is inadequate, your application will be considered incomplete.
- Explain 5 elements:
  - Format of instruction
  - Topics covered (specifics!)
  - Faculty participation
  - Duration
  - Frequency
- Also appropriate to discuss your future plans to ensure you [and your group] maintain a critical focus on science ethics.

For Mentored Ks

- Name a primary mentor (sponsor), who, together with you, is responsible for the planning, direction, and execution of the mentored phase of the application.
  - Should be recognized as an accomplished investigator in the proposed research area AND have a track record of training success.
- You may also name a co-mentor if appropriate
  - Explain why and define the respective areas of expertise and responsibility of each.
  - You and the co-mentors should describe how the three of you will interact and how the different mentors will work with each other to promote your career development.

The Mentor (Co-Mentor) Statement

- A discussion of their research and mentoring qualifications
- A plan that describes the nature of the supervision and mentoring that will occur, including how they will promote your scientific and professional independence
- A description of the elements of the planned research training, including any formal course-work (consistent with your training plan)
- A plan for your transition from the mentored phase to the independent phase of the award.
  - Including a clear statement that the work is YOURS and that it will go with you (NO strings attached) when you leave.
  - Including a statement that they will review the R00 potion of the application

Common Criticisms – K and R grants

- Rationale for hypothesis or methods not sound
- Models over-hyped as relevant to the human situation
- Diffuse, unfocused or superficial examination of the field
- Unexciting science - an incremental advance for the field
- Mediocre preliminary data that are over-interpreted
- Lack of experience in required methodologies
- Unrealistic amount of work
- Lack of sufficient experimental detail
- Too many irrelevant experimental details
- Insufficient discussion of pitfalls and alternate approaches
- Lack of knowledge of published work
- Lacks evidence that the fellow and mentor worked together
- Lack of detail in the training plan; letters from mentors lack depth

What Reviewers Really Say

- This is the first of three very long aims that could make its own proposal. The sub-aims just go on and on.
- An important question and an elegant approach; however there is no discussion of how many targets are expected, and most importantly, what criteria will be used to select which targets to pursue.
- The role of these senior scientists needs to be defined.
- This is a horizontal contribution to the field.
- The investigator does not pay sufficient attention to feasibility issues, including the enrollment of research subjects and careful attention to inclusion issues.
- Insufficient information is given to indicate how the CART analysis will be implemented, and no discussion of power analysis is given. These omissions are particularly unfortunate.

How to Approach a Negative Review

- Give yourself the time and space to feel sad and angry, but appreciate that your colleagues, students, lab members are watching
- Avoid calling or writing your program officer until you have calmed down
- Then read the reviewer's comments CAREFULLY
- You will need to decide whether or not the reviewers show any enthusiasm for your application.
- Talk with:
  - A senior scientist with experience reading critiques
  - Your program officer

Amended Applications

- Can submit one amended application
- Must respond to reviewers' criticisms
  - Do not have to agree or make the suggested changes, but must respond to the comments
  - Do not attack the reviewers' competence, abilities, etc. This will only hurt your cause.
- No guarantees that amended application will score better than previous submission
  - Different reviewers
  - Different panel of applications

An example – Absolute Agreement

Reviewer 1 accurately pointed out that we had not sufficiently discussed the detergents used to prepare cell lysates for our assays. We now expanded this discussion in AIM 3 of the revised application.

Reviewer 2 pointed out that we lacked a clear way to address the relevance of these protein interactions in an animal model. There are no universally accepted animal models for CF lung disease, but we now include studies in mouse tissues and/or well-differentiated human primary airway epithelial (WD-PAE) cell cultures to further explore the physiological relevance of the interactions we identify.

An Example - Graciously Disagreeing

We wholeheartedly agree with Reviewer 2 that unfocused research can indeed lead to “a quagmire of proteins”. However, we have several strategies in place to ensure that we do not go down such a path. Specifically, ……. As proof of principle, our progress since June 2004 clearly indicates that we can rapidly identify important proteins for further analysis. Therefore we have retained the protein interactions screens described in AIM 3 of the original application.

The Psychology of Grant Review

- Reviewers are:
  - Over-committed, over-worked and tired
  - Inherently skeptical and critical
  - Often only peripherally interested in your work
- Make their job easier with:
  - Well-organized, clearly written prose
  - Lots of section headings and breaks in the writing
  - Repeat important points at several places in the application
  - Well designed flow diagrams, charts, figures
- And avoid irritating them by:
  - Exceeding page limits, using small fonts and narrow margins
  - Putting information in the wrong section
  - Omitting or mislabeling references/figures
  - Submitting an application that is sloppy or full of typographical errors

"Simple can be harder than complex. You have to work hard to get your thinking clean to make it simple. But it's worth it in the end, because once you get there, you can move mountains."

It's About More Than The Science

- Observation I:
  - Strong writing can not compensate for bad ideas, but weak writing easily ruins good ideas
- Observation II:
  - You can learn to write well; find outstanding resources as early as possible

Conclusion

- Only some of the deserving applications can be funded
- Maximize your chances for success by
  - Planning ahead
  - Remembering your target audiences
  - Showing the reviewers that you have thought deeply about your project
  - Preparing a reader-friendly application
  - Remaining optimistic, and letting your enthusiasm for your science come through

Helpful Resources

- NIH Home page http://www.nih.gov/
- NIH Grant Application Basics (Includes guides, tips, and tutorials) http://grants.nih.gov/grants/grant_basics.htm
- Information on Study Sections http://cms.csr.nih.gov/
- Visit www.training.nih.gov for access to many career videos on job searches, grant writing, science communication, etc.
- Questions? Want to talk? Email me at milgrams@od.nih.gov