

Building the NIH Grant Proposal

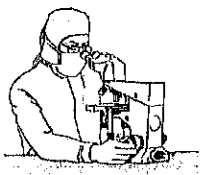


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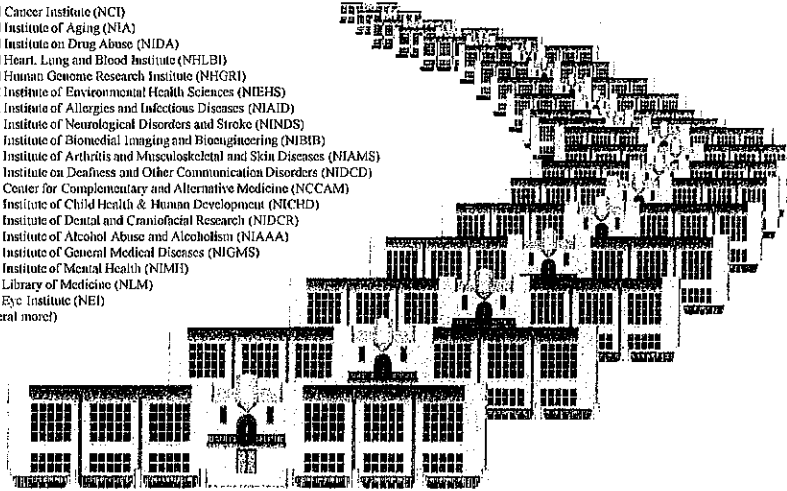
NIH Mission

To acquire new knowledge to help prevent, detect, diagnose, and treat disease and disability, from the rarest genetic disorder to the common cold.

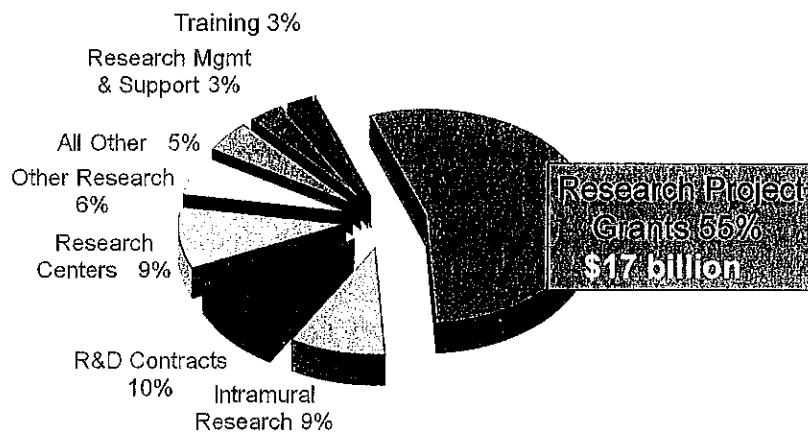


A Collection of Institutes: (DHHS > PHS > NIH)

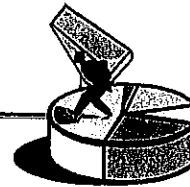
National Cancer Institute (NCI)
 National Institute of Aging (NIA)
 National Institute on Drug Abuse (NIDA)
 National Heart, Lung and Blood Institute (NHLBI)
 National Human Genome Research Institute (NHGRI)
 National Institute of Environmental Health Sciences (NIEHS)
 National Institute of Allergies and Infectious Diseases (NIAID)
 National Institute of Neurological Disorders and Stroke (NINDS)
 National Institute of Biomedical Imaging and Bioengineering (NIBIB)
 National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)
 National Institute on Deafness and Other Communication Disorders (NIDCD)
 National Center for Complementary and Alternative Medicine (NCCAM)
 National Institute of Child Health & Human Development (NICHD)
 National Institute of Dental and Craniofacial Research (NIDCR)
 National Institute of Alcohol Abuse and Alcoholism (NIAAA)
 National Institute of General Medical Sciences (NIGMS)
 National Institute of Mental Health (NIMH)
 National Library of Medicine (NLM)
 National Eye Institute (NEI)
 (and several more)



NIH 2013 Budget \$30.7 Billion



Dividing Up the Money:



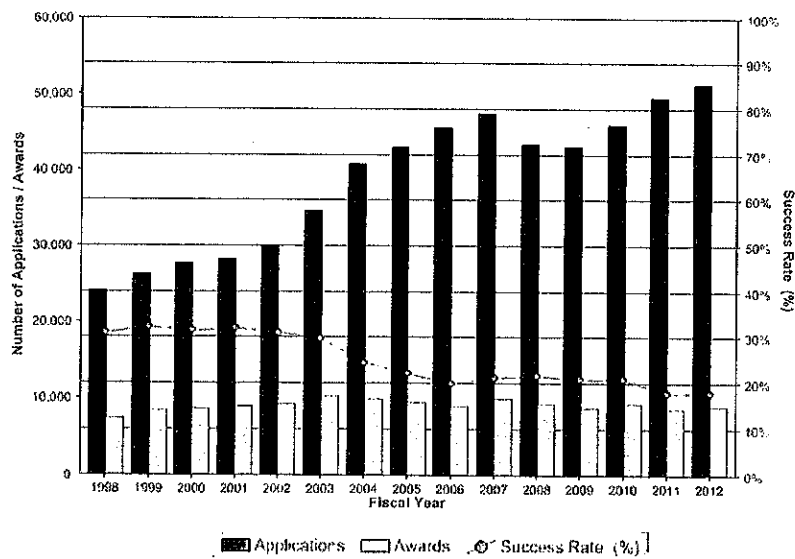
- 80,000+ grant proposals submitted each year
- Proposals reviewed by 258 separate study sections and special emphasis panels--26,000 reviewers!
 - Proposal success rates average from 15 to 25 per cent
 - (Can be as low as 8 – 10 per cent in more competitive programs)
 - Overall success rate of 18% for past two years



National Institutes of Health



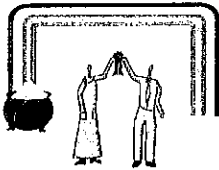
Proposal Success Rates 1998 - 2012



NIH Funding Priorities



- Number of people who have a disease
- Number of deaths caused by a disease
- Degree of disability produced by a disease
- Degree to which a disease cuts short a life
- Economic and social costs of a disease
- Need to act rapidly to control spread of a disease



*Lesson:
Cite data to quantify impact of disease
on health, society and the economy*

New Emphasis: “Translational Research”

- Stresses “bench to bedside” themes
- Seeks more efficient application of basic discoveries to patient care
- Promotes closer collaborations between basic scientists and clinicians
- Supports investigators seeking rapid translation of novel discoveries

*See :NIH “Roadmap”
www.nihroadmap.nih.gov/*



Common Funding Tracks



- R01 – **Research Projects.** A single, circumscribed project proposed by PIs (most common)
- R03 – **Small Research Grants.** Limited support for preliminary short-term projects
- R15 - **Academic Research Enhancement Awards (AREA).** Health professional schools with <\$6M NIH funding annually are eligible
- R21 – **Exploratory/Developmental Grants.** Support new lines of research in specific program areas
- R13 – **Conference.** Support conferences, meetings and workshops
- R25 – **Education Projects.** Support development and/or implementation of projects with emphasis on education, training, or technical assistance
- “K” Awards.** Career Awards--numerous tracks depending on degree and career stage (Go to “K Kiosk” and “K Wizard” pages)



NEW! **PI Awards.** Pathway to Independence (K99R00)
Speeds Postdoc transition from mentored research
to PI status on R01 (5 yr funding)

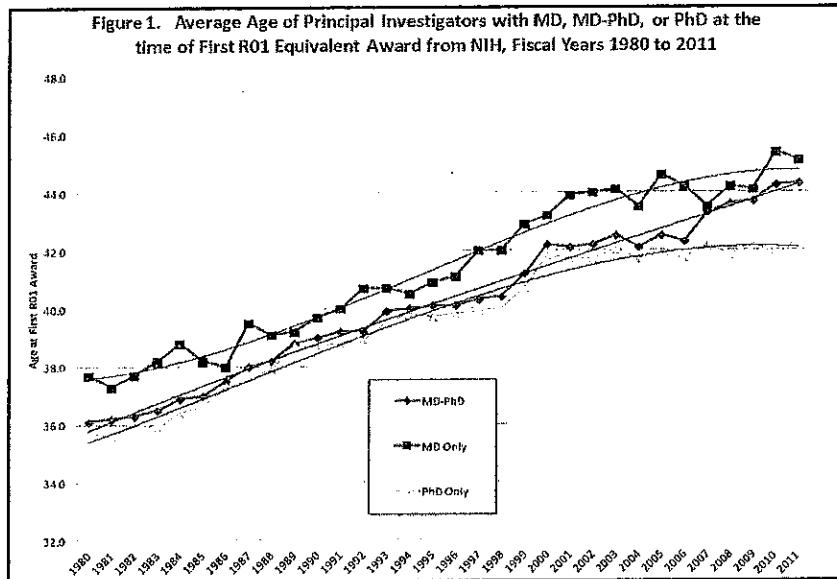
More emphasis on “New” and “Early Stage” investigators”



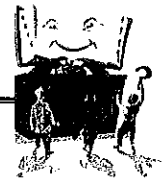
- Designed to give advantage to investigators who have not been a PI on R01 awards
- “Pathways to Independence” accelerates postdocs to tenure-track positions
- “New Innovator” award favors outstanding ideas w/o voluminous preliminary data
- “Early Stage” proposals reviewed more on approach and less on track record and preliminary data
- Many institutes have reserved pools of funds for NI’s

Portal:
http://grants.nih.gov/grants/new_investigators/





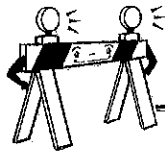
Pretest: NIH “Jeopardy Quiz”



- Answer: 28
- What is the question?
 - ___ How many WMD’s have been found in Iraq?
 - ___ How many states have reduced funding to universities as a result of budget pressures?
 - ___ How many times NIH application instructions say “applicant must,” “length may not exceed,” “application will be deemed incomplete,” or “proposal will be returned without review”?

Best Web Portal: www.grants.nih.gov/grants/oe.htm

The screenshot shows the NIH Office of Extramural Research website. At the top, there is a navigation bar with links for ABOUT GRANTS, FUNDING, FORMS & DEADLINES, GRANTS POLICY, eRA, and NEWS & EVENTS. Below this is a large banner for "Grants & Funding". The main content area is divided into several sections: "About Grants" with a list of links, "New to NIH Grants?" with a search box, "FUNDING" with a search box, and "Rock Talk" with a video player. There are also several news items and a sidebar with "About OER" and "Global Resources".



Warning: Electronic Submission Required!

- Major change from PHS 398 paper forms to SF 424 electronic forms (www.Grants.gov)
- All "R" tracks required
- Grants.gov now mature, but still cumbersome for first time users



Remember:
Body of grant remains much the same, but
START EARLY
working with sponsored research office!

Keys to Successful Applications

- ❖ Original, compelling ideas
- ❖ Focused research & administrative plans
- ❖ Appropriate resources/facilities
- ❖ Knowledge of relevant published work
- ❖ Success with earlier work (preliminary data)
- ❖ Future directions and contingency plans
- ❖ Adequate staff with experience/training in essential methodology
- ❖ Prepared according to NIH requirements



Top Ten Reasons for Failure*

1. Lack of original ideas
2. Diffuse, unfocused or superficial Research Plan
3. Lack of knowledge of relevant published work
4. Lack of experience in essential methodology
5. Uncertainty concerning future directions
6. Questionable reasoning in experimental approach
7. Absence of acceptable scientific rationale
8. Unrealistically large amount of work
9. Lack of sufficient experimental detail
10. Uncritical approach



**presented at an NIH grants conference*



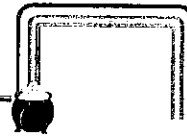
Planning the Application:

- Plan for 3 – 6 months to write the application
- List some ideas that excite you; test them with colleagues (form your own review panel!)
- Study program goals, Program Announcements (PA) or Request for Applications (RFA) carefully
- Search RePORTER database to see what related projects have been funded; carve out your niche
- Sharpen the focus of your application (simple, testable hypothesis, 3-4 specific aims); test with colleagues!
- Contact key NIH Program Officers; test idea(s) for “fit”

Key Question: GO/NO GO?



If “GO”...



- Read the SF424 Application Guide carefully
- Contact the Research Office; establish working relationship
- Be prepared to address 5 traditional NIH review criteria

- Significance: ability of project to improve health
- Approach: feasibility of methods & budget
- Innovation: originality of your approach*
- Investigator: qualifications and experience of investigator(s)
- Environment: suitability of facilities, equipment & institutional support

- Plus the NEW criterion: IMPACT!

*NB: too much innovation can be risky

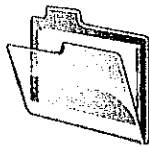


Planning the Application, cont'd:

- **Map out deadlines and benchmarks for proposal development, working back from the submission date**
- **Note where an institutional approval, e. g., IRB review, has to be scheduled**
- **If submitting a revised application, provide detailed explanation of all changes (1 page allowed)**
- **Postdocs: Start early to get letters of reference and institutional commitment (very important to reviewers)**

Remember:

Establishing your credibility can be as important as the topic you're proposing



Key Sections of the Application:

- **Description (Abstract)***
- **Research Plan**
- **Budget**
- **Assurances**
- **Biographical Sketch**
- **Resources and Environment**
- **Appendix**



**NB: Do this last!*

The Abstract

- **PURPOSE:** Describe succinctly every major aspect of proposed project except budget
- Used to assign institute and study section
- **Length:** 1/2 page (space provided)
- **Should touch briefly on:**
 - Background and significance of proposed research
 - Specific aims or hypothesis
 - Unique features of project
 - Methodology (action steps) to be used
 - Expected results
 - Evaluation methods



Tips for the Abstract:

1. Strive to be **COMPLETE** though **BRIEF**
2. View it as a **one page advertisement**
3. Write it **last** after you've completed the entire proposal
4. **DO NOT** merely cut and paste from the first page of the project description
5. **Keep in mind purposes other than the review:**
 - Brief description of your project for annual reports
 - Requests from top management at NIH

Remember:

*This may be the only section that some reviewers will read!
Make it a brief "stand alone" statement of the scope,
methods and significance of your project*



Research Plan: Overview

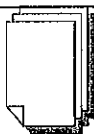
- **CORE OF THE PROPOSAL. Describes:**

- *What:* Specific Aims
- *Why:* Significance & Innovation
- *How:* Approach
 - Research Design & Methods
 - Preliminary Results



- **CONTENTS. Must answer:**

- What do you intend to do?
- Why is it important? How is it innovative?
- What has already been done in the field? How will you add to it?
- What have you done to establish the feasibility of your methods?
- How will the research be accomplished? (*Who, What, When, Where, Why*)



Research Plan: New Format & Page Limits!

1. **Introduction:** (Resubmitted proposals only: +1 page)
2. **Specific Aims:** 1 page (All “R” proposals)
3. **Research Strategy**
 - a. **Significance**
 - b. **Innovation**
 - c. **Approach (Research Design & Methods)**
 - Preliminary Studies (new applications)
 - Progress Report for renewals



New page limits for Research Strategy (a+b+c):

R01 = 12 pages (down from 25!)

R03, R21 = 6 pages (down from 11!)

“Enhancing Peer Review” initiative:
<http://enhancing-peer-review.nih.gov/index.html>



Tips for the Research Plan:

1. Make sure that all sections (**Specific Aims/Research Strategy**) are internally consistent and dovetail with each other.
2. Show knowledge of recent literature and how you will build upon it.
3. Emphasize how some combination of a) a novel hypothesis; b) important preliminary data; and c) a new experimental approach *will enable important progress to be made*.
4. Establish credibility of the PI and co-investigators.

Remember:

*Make it easy to read & follow the logic of your argument:
Use white spaces, pictures, bold headings, numbering*



Research Plan Part 2: Specific Aims

- **PURPOSE:** To describe concisely and realistically what the proposed research is intended to accomplish
- **CONTENTS. Should cover:**
 - The project's overall purpose and broad goals
 - Hypothesis or hypotheses to be tested (if an experimental design)
 - Specific, time-phased research objectives ("specific aims")





Tips for Part 2: Specific Aims

1. Start with a brief narrative describing the long term goals of the project, followed by a specific, testable hypothesis, followed by 2 – 4 Specific Aims, numbered.
1. Make sure the hypothesis is adequately supported by citations in Part B (Background & Significance), and by data in Part C, (Preliminary Results). Show that the objectives are attainable within the stated time frame in Part D (Research Design & Methods).
2. State each Specific Aim in a single concise sentence.
3. Be sure all aims are related; test for clarity and cohesiveness.

Remember:

- *A small, focused project has a better chance than a diffuse, multifaceted one;*
- *You are unlikely to get money merely to study something or collect data.*



Develop a solid hypothesis!



A tentative assumption made in order to draw out and test its logical or empirical consequences.

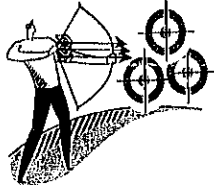
--Webster's

- The foundation of most successful NIH grants
(Exceptions: Studies of bioterrorism, design of biomedical devices, software for computational biology, etc.)
- Structure a statement that will be proved or disproved by the experimental design

Good: *Analogues to chemokine receptors can inhibit HIV infection.*

Bad: *Analogues to chemokine receptors can be biologically useful.*

Worse: *A wide range of molecules can inhibit HIV infection.*



Specific Aims

Aims (research objectives) must be focused, logically coherent, and capable of testing the hypothesis

Hypothesis: Components of automobile exhaust accelerate the degradation of statuary in Washington DC

Aim 1: To determine the content of sulfur, lead and copper in statuary as a function of age

Aim 2: To correlate the rate of degradation with the introduction of unleaded gasoline in the DC area



Part 3: Research Strategy

a. Significance

- **PURPOSE:** Present a convincing scholarly argument for your proposed project
- **CONTENTS:**
 - Highlight the problem to be investigated and its importance
 - Summarize the current state of existing knowledge, with citations and relevant data
 - Justify your research approach
 - Identify gaps or limitations that your project will address
 - Show how your research will impact public health



Tips for Research Strategy

3a. Significance

1. Be persuasive; cite authoritative sources to prove the importance of the research problem
2. Cite enough relevant research to show familiarity with state of the art scholarship
3. Acknowledge differences that may exist in the field
4. Embrace creativity; stress innovations in experimental methods or proposed interventions (**BUT** justify their feasibility!)
5. Show how this work will advance the field

Remember:

The foundation of your argument should always come back to how your research supports the goals and objectives of the program you're applying to



Part 3: Research Strategy

b. Innovation

- **PURPOSE:** Describe how the research will utilize novel concepts, approaches or methodologies to advance knowledge
- **CONTENTS:**
 - Describe the project's unique qualities
 - Emphasize original applications of theoretical concepts
 - Justify the use of new methodologies, or the development of new instrumentation

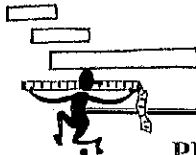


Tips for Research Strategy

3b. Innovation

1. Justify originality by citing data that show improvements or better results
2. Show how the new approach will accomplish research goals and objectives better or more efficiently than existing methods
3. Demonstrate the feasibility of your innovations: Present your case in a way that promises project success

Remember:
Too much innovation magnifies the element of risk!



Part 3: Research Strategy

c. Approach

PURPOSE: Provide detailed description of how the research will be carried out

- **CONTENTS: Should include**
 - An overview of the design
 - Details of methods to be used for each specific aim
 - Methods for collecting, analyzing and interpreting results
 - Sequential work plan: Activities, timelines, responsibilities
 - Discussion of challenges and limitations and how they will be overcome or mitigated
 - Expected results (or alternative approaches, if needed)
 - Precautions to be taken if hazards are involved



Tips for Research Strategy

3c. Approach

1. Number the sections to correspond to numbers of Specific Aims
2. Where possible cite your own publications to show familiarity with experimental techniques
3. Justify your approach by stating why you chose your method(s) over alternatives (*the "why" as well as the "how"*)
4. If you must use a complex technology for the first time, add a co-investigator or experienced consultant
5. Document proposed collaborations and offers of restricted materials or equipment with letters of authorization

Remember:

Pictures do more than words: Use charts, illustrations and graphs to help reviewers "see" exactly how the project will unfold



Part 3: Research Strategy

c. Preliminary Results

- **PURPOSE:** Provide experimental support for hypothesis and research design; establish capabilities of investigators
- **CONTENTS:** Should include
 - Brief description of recent studies done by investigators that establish feasibility of the proposed design
 - Reference to older studies that provide important background
 - Results of previous studies not directly relevant can help if they verify competence with the proposed experimental techniques



Tips for 3c: Preliminary Results

1. Show how previous work has prepared you to conduct this research successfully
2. All figures, tables and illustrations of preliminary data must be in this section
3. Color images okay with Grants.gov, but check w/B&W printer
4. If originals are reduced, make sure legends are readable
5. Cite but do not dwell exhaustively on results already published. Summarize key findings and include reprints in the appendix (up to 10)

Remember:

"It is virtually impossible to obtain a favorable review without strong preliminary data."

- NCI Grantwriting Guide



Budget and Justification

- **Modular: Less than \$250,000 per year**
 - Only need to list personnel and % effort (LOE)
 - No other itemization necessary
 - Direct costs requested in modules of \$25,000
 - **Non-modular: > \$250,000 per year**
 - Requires detailed itemization (forms 4 & 5)
- NB: Budgets > \$500,000/yr require NIH approval prior to submission (at least 6 weeks in advance)
- **PURPOSE: Justify all expenses required to achieve project aims and objectives**
 - **Recommended Length: Special forms provided. Read instructions carefully!**



Budget Tips

1. Be realistic. Padding and deliberate underbudgeting are quickly spotted.
2. Describe specific duties and name the individuals for each position listed, with percentage of effort requested each year

If non-modular:

1. Justify all equipment purchases
2. Break out supply costs into major categories (reagents, disposables, etc.)
3. Detail and justify all travel costs
4. All budget items and year-to-year fluctuations should match the research plan 1:
5. Be complete but concise (no page limits)

Remember:

Failure to adequately justify expenditures will cause reviewers to question the validity of your research plan!



Assurances and Certifications

- **PURPOSE: Document institutional compliance with all relevant federal laws and guidelines**

- **CONTENTS. Required Assurances:**

Human Subjects	Human Fetal Tissue	Vertebrate Animals
Embryonic Stem Cells	Inclusion of Children	Women & Minority Inclusion
Debarment & Suspension	Drug-Free Workplace	Lobbying
Delinquent Federal Debt	Research Misconduct	Handicapped Individuals
Civil Rights	Sex Discrimination	Age Discrimination



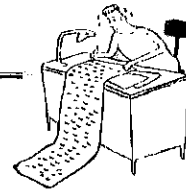
Tips re: Assurances

1. Become familiar with all compliance requirements that pertain to your proposal, especially if your research involves:
 - Human Subjects
 - Vertebrate Animals
 - Recombinant DNA/RNA
 - Human Gene Transfers
 - Biohazards
 - Hazardous Materials
 - Radioactivity
 - Conflict of Interest
2. Allow plenty of time, as some compliance documentation may have to come from other institutions.
3. Make contact early with the Office of Sponsored Programs!
4. IRB approval not necessary with proposal, but no money will flow until it's obtained!

Remember:

Lack of proper certifications and assurances will cause your proposal to be returned without review!

Biographical sketches



- **PURPOSE: Provide credentials of all key personnel in concise, standard format**
- **Format pages provided (limited to 4 pages)**
 - Education/Training
 - A. Positions and Honors
 - B. Selected Peer-reviewed publications
 - C. Research Support (Ongoing & Completed)



Resources and Environment

- **PURPOSE:** Describe the resources, facilities and support available to the researcher
- **Recommended Length:** Form provided
- **Make sure you:**
 1. Include all requirements mentioned in proposed Research Plan
 2. Justify any reliance on external resources
 3. Show that all subcontractors and collaborators have the capability to perform assigned tasks
 4. Match resources with budget requests

Appendix



- **PURPOSE:** Provide relevant supplemental material
- **May include:**
 - Up to 10 publications or manuscripts accepted for publication
 - Abstracts, patents or other relevant material
 - Surveys, questionnaires, data collection instruments, clinical protocols
- **Not advisable for any commonly known protocol or procedure**

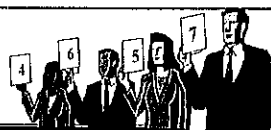
NB: Do not use to circumvent the 12 page limit!

NIH Peer Review: New Scoring System



- **9-point** scale introduced in 2010
(1 = “Exceptional” and 9 = “Poor”)
- Most important new score will be the final **IMPACT** rating:
(1 to 9)
- Ratings will be in whole #'s only; no decimals
- Reviewers will also provide ratings for each of five traditional NIH criteria
 - Significance
 - Investigator(s)
 - Innovation
 - Approach
 - Environment

New Scoring System, cont'd



- Preliminary score: Reviewers send in their scores for the 5 present review criteria, plus the final IMPACT score
- **Note: Impact score is an independent rating, not an average of the 5!**
- Applications in the lower half are “less competitive,” and will Not be Discussed
- PI's of “ND” proposals WILL receive all scores from individual reviewers, but no overall IMPACT score
- After discussing competitive proposals, reviewers may change their scores
- Reviewer scores are averaged, x 10, for a range of 10 – 90
- Average IMPACT scores are then percentiled for final ranking to determine funding order

Scoring System, cont'd




Definition of 9 – point scale:

Category	Score	Qualitative Description	Qualitative Description of Strengths and Weaknesses
High	1	Exceptional	Exceptionally strong with essentially no weaknesses
	2	Outstanding	Extremely strong with negligible weaknesses
	3	Excellent	Very strong with only some minor weaknesses
Medium	4	Very Good	Strong but with numerous minor weaknesses
	5	Good	Strong but with at least one moderate weakness
	6	Satisfactory	Some strengths but also some moderate weaknesses
Low	7	Fair	Some strengths but with at least one major weakness
	8	Marginal	A few strengths and a few major weaknesses
	9	Poor	Very few strengths and numerous major weaknesses

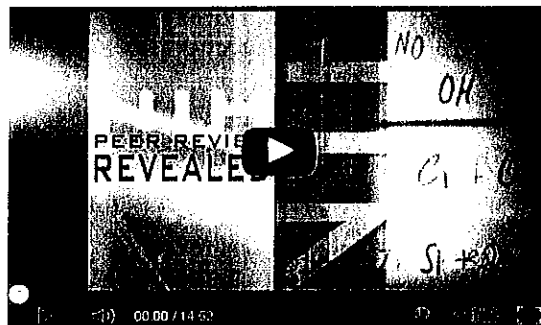
Non-numeric score options: NR = Not Recommended for Further Consideration, DF = Deferred, AB = Abstention, CF = Conflict, NP = Not Present, ND = Not Discussed

Minor Weakness: An easily addressable weakness that does not substantially lessen impact
Moderate Weakness: A weakness that lessens impact
Major Weakness: A weakness that severely limits impact

NIH Study Section Video

national institutes of health
 center for scientific review the measure and future of science and health

NIH Peer Review Process Revealed



www.csr.nih.gov/



Guides for NIH proposals

- Yang, Otto. Guide to Effective Grant Writing. Springer, New York, 2005
- Ogden, Thomas E. and Israel A. Goldberg. Research Proposals: A Guide to Success, 3rd edition. Academic Press, San Diego, 2002
- Reif-Lehrer, Liane. Grant Application Writer's Handbook, 4th edition. Jones and Bartlett, Boston, 2005
- Gerin, William. Writing the NIH Grant Proposal: A Step-by-Step Guide. Sage Publications, Thousand Oaks CA, 2006



Some Final Tips for Success...

- Read successful proposals
- Look up study section charters, rosters & prior awards
www.csr.nih.gov/Committees/rosterindex.asp / RePORTER database
- Develop an “elevator speech” for your project
- Contact program officer(s) early and often
- Learn the basics of Grants.gov
- Follow application instructions exactly
- Use direct English (basic, concise, active voice);
avoid jargon (especially in early sections)





More Tips for Success...

- Observe type size and page limits strictly; NO TNR!
(Arial, Helvetica, Palatino, Linotype, Georgia, 11 or larger)
- Use plenty of visual illustrations; trust white spaces
- Ask informed readers to check for clarity and consistency
- Engage a final proofreader (not an investigator!)
- Use checklist to assure required items are completed
- Give yourself plenty of time for rewrites and final polishing
- **Prepare to resubmit!**



