Thinking Like a Grant Reviewer: Know the Score!

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Topics

- Overview of grant review processes at NSF and NIH
  - Proposal volumes
  - Number of reviewers
  - Awards and success rates
  - Review processes

- Summary of reviewer research findings
  - Review panel objectivity
  - Peer Review strengths and weaknesses
  - Recommendations for improvements

- Recent innovations
NSF Overview

• An independent Federal agency
• Funds research and education in most fields of science and engineering
• Annual budget: ~ $7 billion
• Receives 55 - 65,000 proposals each year
• Proposal success rates have leveled off at 23-25% in recent years
Nearly all are active researchers, selected for scientific expertise and communication skills

- Number serving on panels: 15,500
- Mail reviewers: 30,500
- Serving on both: -4,200
- Total: 41,800
- 1st time reviewers: 9,400
NUMBER OF NSF COMPETITIVE PROPOSALS, NEW AWARDS, AND FUNDING RATES

FY 2008: 11,024 competitive proposals, 25% new awards, 75% competitive proposals.
FY 2009: 14,642 competitive proposals, 32% new awards, 68% competitive proposals.
FY 2010: 13,015 competitive proposals, 23% new awards, 77% competitive proposals.
FY 2011: 11,207 competitive proposals, 22% new awards, 78% competitive proposals.
FY 2012: 11,534 competitive proposals, 24% new awards, 76% competitive proposals.

Legend:
- Light blue: Competitive proposals
- Dark blue: New awards
- Orange line: Funding rate (%)
Proposal Success Rates by Directorate: FY2011

<table>
<thead>
<tr>
<th>Directorate</th>
<th>New Awards</th>
<th>Funding Rate</th>
<th>Median Annual Award</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical And Physical Sciences</td>
<td>2,669</td>
<td>27%</td>
<td>$115,000</td>
</tr>
<tr>
<td>Social, Behavioral &amp; Economic Sciences</td>
<td>1,257</td>
<td>20%</td>
<td>$101,000</td>
</tr>
<tr>
<td>Computer &amp; Info Science &amp; Eng</td>
<td>1,586</td>
<td>23%</td>
<td>$150,000</td>
</tr>
<tr>
<td>Geosciences</td>
<td>1,686</td>
<td>31%</td>
<td>$124,000</td>
</tr>
<tr>
<td>Engineering</td>
<td>2,375</td>
<td>17%</td>
<td>$100,000</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>1,556</td>
<td>18%</td>
<td>$172,000</td>
</tr>
<tr>
<td>Education &amp; Human Resources</td>
<td>930</td>
<td>17%</td>
<td>$147,331</td>
</tr>
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Average NSF success rate (2011): 22%
What makes a proposal competitive?

- Significance (important area of research)
- Original approach
- Strong likelihood of success, i.e., will make a significant contribution to the field
- Knowledge and experience in the discipline
- Experience in essential methodology
- Succinct, logical and focused project plan
- Realistic amount of work
- Sufficient detail
- Cost effective
Common Reasons for High Ratings

➢ “This proposal suggests a clear, elegant, well-documented approach to a problem that has plagued this field for decades.”

➢ “The PI has a beautiful plan. Undergraduates or new graduate students can step right into this work, yet it solves a major problem and will be publishable in a first-rate journal.”

➢ “This is certainly adventurous, and I frankly would have doubted it could be done. Yet the PI has proven the method in preliminary work AND had it accepted by a peer-reviewed journal!”

➢ “This reads like a dream. I have rarely seen a proposal, even from long-established investigators, that shows such careful thought and meticulous presentation.”
Common Reasons for Low Ratings

- **Poor fit.** "An interesting idea, but it doesn’t really fit the goals of this program.

- **Weak on significance and/or innovation.** “The work can certainly be carried out, but it doesn’t address any topic of broad current interest. I would probably not read a paper describing the results.”

- **Lack of specific project focus.** “Why all the rambling, this seems like a fishing expedition.”

- **Vague research plan.** “I really can’t tell what is going to be done and how.” (aka “Trust me” syndrome)

- **Low probability of success.** “The PI doesn’t provide sufficient evidence that this approach is likely to work.”

- **Unrealistic work plan and/or budget.** Scope of the work out of proportion to the budget and length of time required
General NSF Review Criteria

- What is the **intellectual merit** of the proposed activity?
- What are the **broader impacts** of the proposed activity?

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- **Program specific criteria** may be listed in the program announcement

*Both have slightly revised definitions for 2013*
1) How important is the proposed activity to *advancing knowledge and understanding* within its own field or across different fields?*

2) How *well qualified* is the proposer to conduct the project?

3) To what extent does the proposed activity explore *creative, original, or potentially transformative concepts*?

4) How *well conceived and organized* is the proposed activity?

5) Is there sufficient *access to necessary resources*?

*Strongest emphasis in new definition*
Broader Impacts – 5 strands

1. What may be the **benefits** of the proposed research to society?*
2. How well does the activity advance discovery and understanding while **promoting teaching, training and learning**?**
3. How well does the proposed activity **broaden the participation** of women and underrepresented groups? (“Diversity”)
4. To what extent will it **enhance the infrastructure for research and education**, such as facilities, instrumentation, networks and partnerships?
5. Will the results be **disseminated broadly to enhance scientific and technological understanding**?

*New emphasis in 2013
**Integration of education with research required of all NSF proposals!
NSF: Possible rankings by reviewers

Individual rankings:

- “Excellent”
- “Very Good”
- “Good” (not good!)
- “Fair”
- “Poor”

Panel recommendation:

- “HIGH PRIORITY”
- “MEDIUM PRIORITY”
- “LOW PRIORITY”
- “DO NOT FUND”

Remember:
Only those proposals with a majority of “Excellents” are likely to be funded; PO’S have some flexibility.
NSF:

Distribution of Average Reviewer Ratings for Awards and Declines, FY 2010

Awards: 13,000
Declines: 43,000
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 Diseases (NIGMS)
National Institute of Mental Health (NIMH)
National Library of Medicine (NLM)
National Eye Institute (NEI)
(and several more!)
NIH 2012 Budget
$30.7 Billion

Research Project
Grants 55%
$17 billion

Training 3%
Research Mgmt & Support 3%
All Other 5%
Other Research 6%
Research Centers 9%
R&D Contracts 10%
Intramural Research 9%
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
Number of Reviewers 1999 - 2008
Proposal Success Rates 1998 - 2012
Proposals must address 5 traditional NIH review criteria:

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

**NEW criterion: IMPACT!**

- Most important, as it alone determines percentile ranking
- Only assigned to proposals discussed (upper half)
- Arrived at independently from scores for other criteria
Peer Review: New Scoring System

- Old **1 to 5** scale replaced by a **9-point** scale
  (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 numerical 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 traditional 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**
### Definition of 9-point scale:

<table>
<thead>
<tr>
<th>Impact</th>
<th>Score</th>
<th>Descriptor</th>
<th>Additional Guidance on Strengths/Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>1</td>
<td>Exceptional</td>
<td>Exceptionally strong with essentially no weaknesses</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Outstanding</td>
<td>Extremely strong with negligible weaknesses</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Excellent</td>
<td>Very strong with only some minor weaknesses</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Very Good</td>
<td>Strong but with numerous minor weaknesses</td>
</tr>
<tr>
<td>Medium</td>
<td>5</td>
<td>Good</td>
<td>Strong but with at least one moderate weakness</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Satisfactory</td>
<td>Some strengths but also some moderate weaknesses</td>
</tr>
<tr>
<td>Low</td>
<td>7</td>
<td>Fair</td>
<td>Some strengths but with at least one major weakness</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Marginal</td>
<td>A few strengths and a few major weaknesses</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Poor</td>
<td>Very few strengths and numerous major weaknesses</td>
</tr>
</tbody>
</table>

**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
New NIH Videos

NIH Grant Review Process YouTube Videos

NIH Peer Review Revealed

CSR has produced a series of videos to give you an inside look at how scientists from across the country review NIH grant applications for scientific and technical merit.

New and established applicants will find insights and understanding that can empower them to improve the applications and increase their chances for receiving a more positive review.

Get Answers to Your Questions About the Video

View our Video FAQs document (PDF).

Note: Since application submission and review policies discussed in the video may change, you should check for policy updates on the CSR and the NIH Office of Extramural Research Web sites.

http://cms.csr.nih.gov/
“Applicant Resources”
• Grant Review Process Videos
What Do Grant Reviewers Really Want, Anyway?

Profile of Reviewers Interviewed:

• 16 Senior faculty at Virginia Tech; 10 men, 6 women
• 12 full professors (2 Associate Deans for Research); 6 associate professors
• Disciplines: Physical Sciences and Engineering, Social and Behavioral
• Average number of review panels served: 10
• Top funding agencies: NSF, NIH, USDA, DoD
• Average awards earned in five years: 8.3 (1999 – 2004)
• Average dollars awarded : $2.2 million

Paper: http://www.nordp.org/resources
Objectivity of review panels:

*While disgruntled PIs sometimes accuse panels of being biased:*

**Reviewers rate objectivity highly:**

- Bias seen as “nil” or “nonexistent”
- “System isn’t perfect, but it’s the fairest one possible.”
- Panel dynamics are democratic and self-correcting
- Very difficult for any one person or group to dominate
- BUT: Occasionally there is some favoritism to senior researcher based on past record (“funding on the come”)
Peer review strengths:

- System epitomizes democratic self-determination (Researchers chart their own future direction)

  “The research community decides its own fate by determining what good science is.”

- Panels are diverse, assuring a good cross section of ideas

- Despite weaknesses, still best means to preserve scientific integrity
Peer review weaknesses:

- Strongly opinionated panelist can exert undue influence on group
- "Veto" effect: Just one less than enthusiastic comment by a discussion leader can doom a proposal
- Workloads can be heavy; hard to give a fair hearing to large number of proposals in single batch
- Gender tax: Women especially pressured to participate more often
- Splitting hairs: With intensifying competition, many decisions based on minor qualities
- Incrementalism: Panels stay safe, too often shy away from more daring ideas

Summing up (cont’d)…
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Final recommendations from reviewers:
- Allow more time for panel meetings
- Find ways to recruit more reviewers, lighten work load
- Allocate more money to exploratory, high risk work
Some good news…

Recently…

NSF has:
• Placed increasing emphasis on “transformational potential” in its review process
• Implemented EAGER and RAPID awards for exploratory work and research with a sense of urgency

NIH has:
• Reduced maximum proposal page lengths by half
• Introduced more flexible scoring for New and Early Stage investigators
• Required reviewers to provide written feedback to all PIs on five major review criteria