Materials Research at the National Science Foundation

……Plus: Writing Effective (NSF) Proposals in Materials Research

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On Behalf of Dr. Zakia Kafafi
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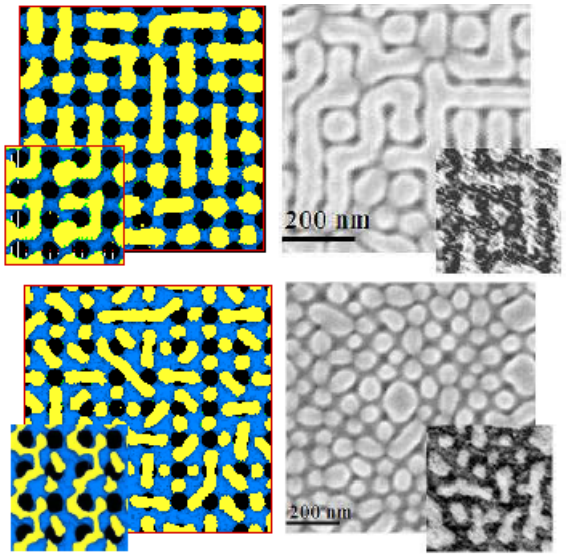
National Science Foundation

Energy Long Island 2007 Conference
October 28, 2007

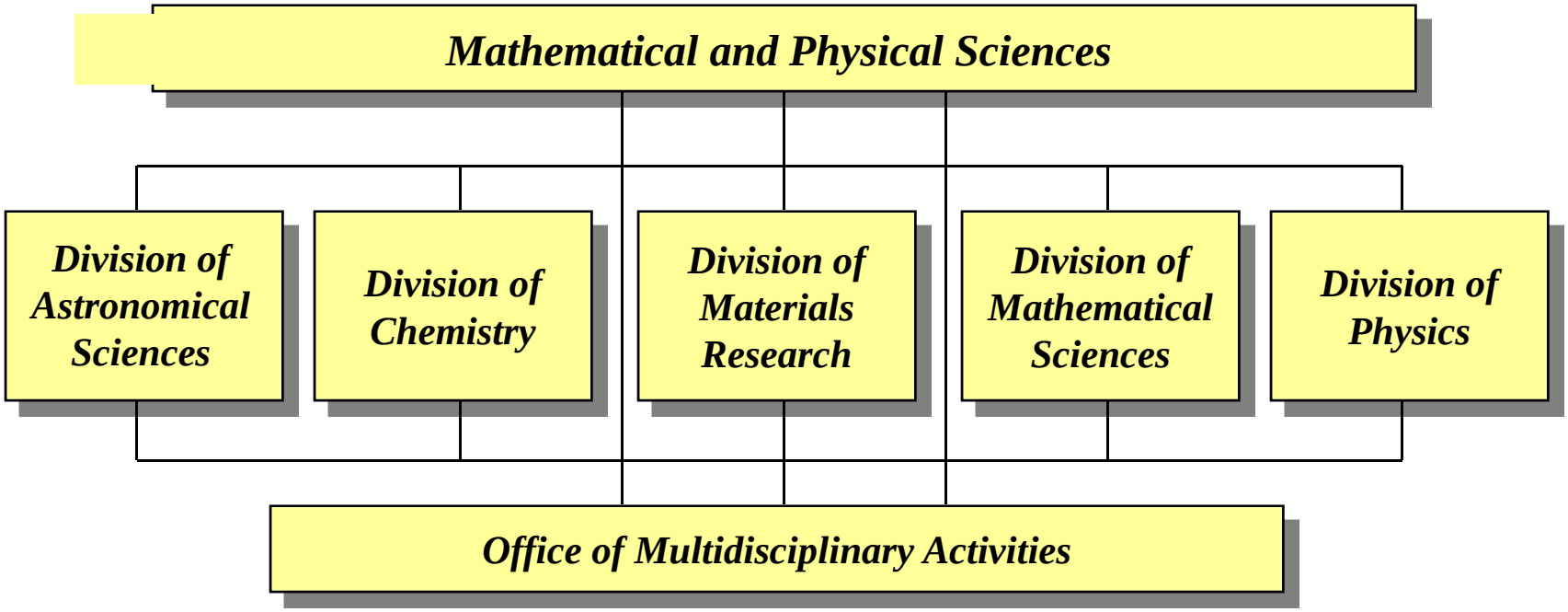
NSF Support for Materials Research



Self-assembly on patterned substrates – Paul Nealey & colleagues, U Wisconsin NSEC

- **From fundamental condensed-matter phenomena to functional materials …devices, and systems**
- **Phenomena, synthesis, processing, properties, theory and modeling, characterization … devices, manufacturing**
- ***Basic research*, but often with potential future application**
- **Our 'community' is very broad: *materials scientists, engineers*, *chemists, physicists,* biologists, mathematicians, computer scientists, educators…**

Directorate for Mathematical and Physical Sciences



Division of Materials Research

Focus for Diverse Communities and Funding Modes

- *Individual Investigators and Groups*
  - **Condensed Matter and Materials Theory, Condensed Matter Physics, Solid State & Materials Chemistry, Polymers, Biomaterials Metals, Ceramics, Electronic/Optical Materials**
- *Cross-cutting Programs in DMR*
  - **Centers & Partnerships**
  - **User Facilities**
  - **Instrumentation**
  - **Office of Special Programs (International Collaboration; Education)**
- *Distributed Mechanisms*
  - **Focused Research Groups**
  - **NSF-wide programs – *REU/RET, CAREER, GOALI, SGER, MRI …***
  - ***DMR is a major partner in NANO***
- *Connections & co-funding*
  - **Other areas of NSF, other agencies, international, industry, nat'l labs**

DMR Scientific Staff

* Acting

Division Director	Lance Haworth*	Zakya H. Kafafi, Oct. 15, 2007
Executive Officer	Ulrich Strom*	
Sr. Staff Associate	Lorretta Hopkins	

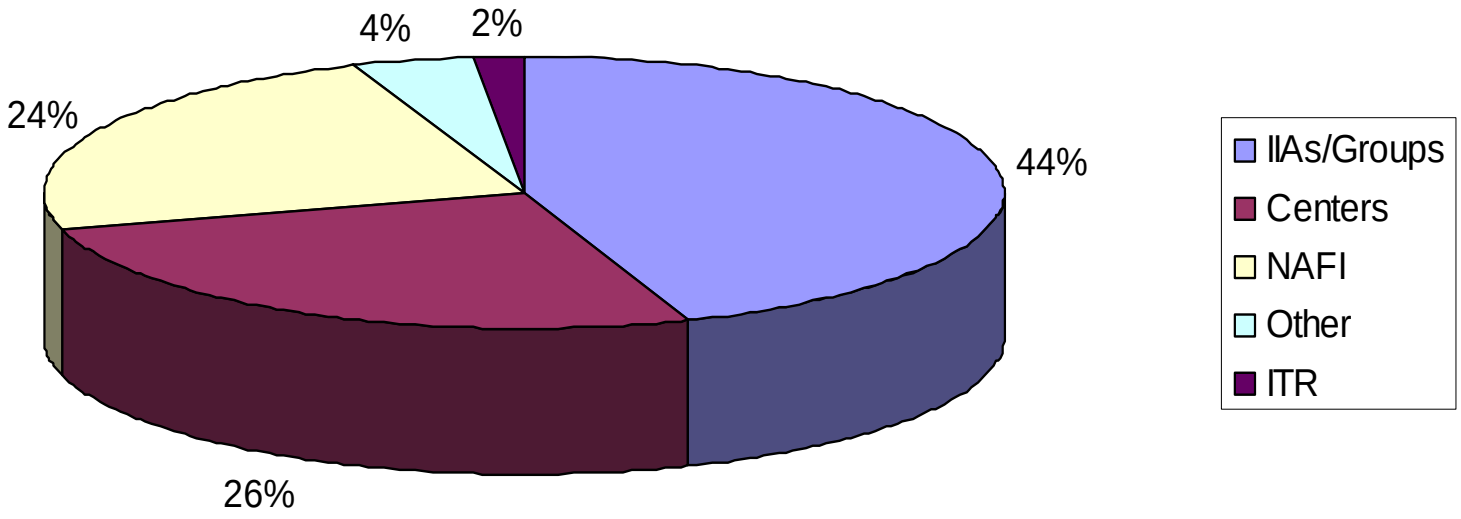
CMP	Wendy Fuller-Mora, Roy Goodrich, Satyen Kumar
CMMT	Daryl Hess, Michael Lee
Metals	Harsh Deep Chopra, Bruce MacDonald
Ceramics	Lynnette Madsen
Electronic Materials	Verne Hess, Charles Ying
Polymers	Andy Lovinger, Freddy Khoury
Solid State and Materials Chemistry	David Nelson Akbar Montaser
Biomaterials	David Brant, Joe Akkara
Special Programs	Carmen Huber, Uma Venkateswaran
Instrumentation	Chuck Bouldin
User Facilities	G.X. Tessema
MRSEC	Maija Kukla, Tom Rieker, Rama Bansil (Charles Ying)
Volunteers	Udo Pernisz (CMP), Michael Owen (SSC)

Recent "DMR" Nobel Laureates

- Physics
  - 96 Lee, Osheroff, Richardson
  - 97 Chu, Tannoudji, Phillips
  - 98 Tsui, Stormer, Laughlin
  - 00 Alferov, Kroemer, Kilby
  - 03 Abrikosov, Ginsberg, Leggett
- Chemistry
  - 96 Curl, Smalley, Kroto
  - 98 Pople, Kohn
  - 99 Zewail
  - 00 McDiarmid, Heeger
  - 03 Agre, MacKinnon
  - 05 Chauvin, Schrock, Grubbs

DMR Support for Materials

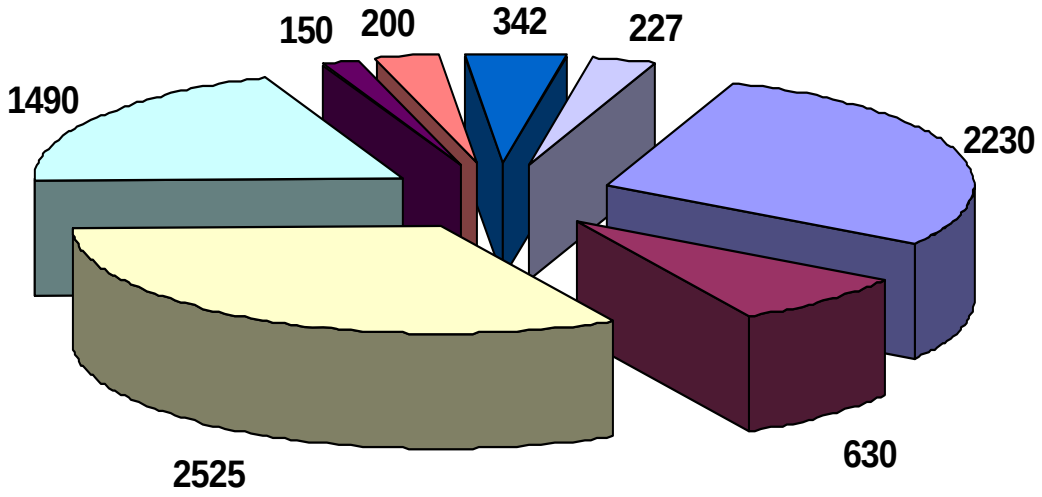
FY 2006
$252.2M
(includes MRI)



<u>Total</u> NSF support for materials is over $400M annually

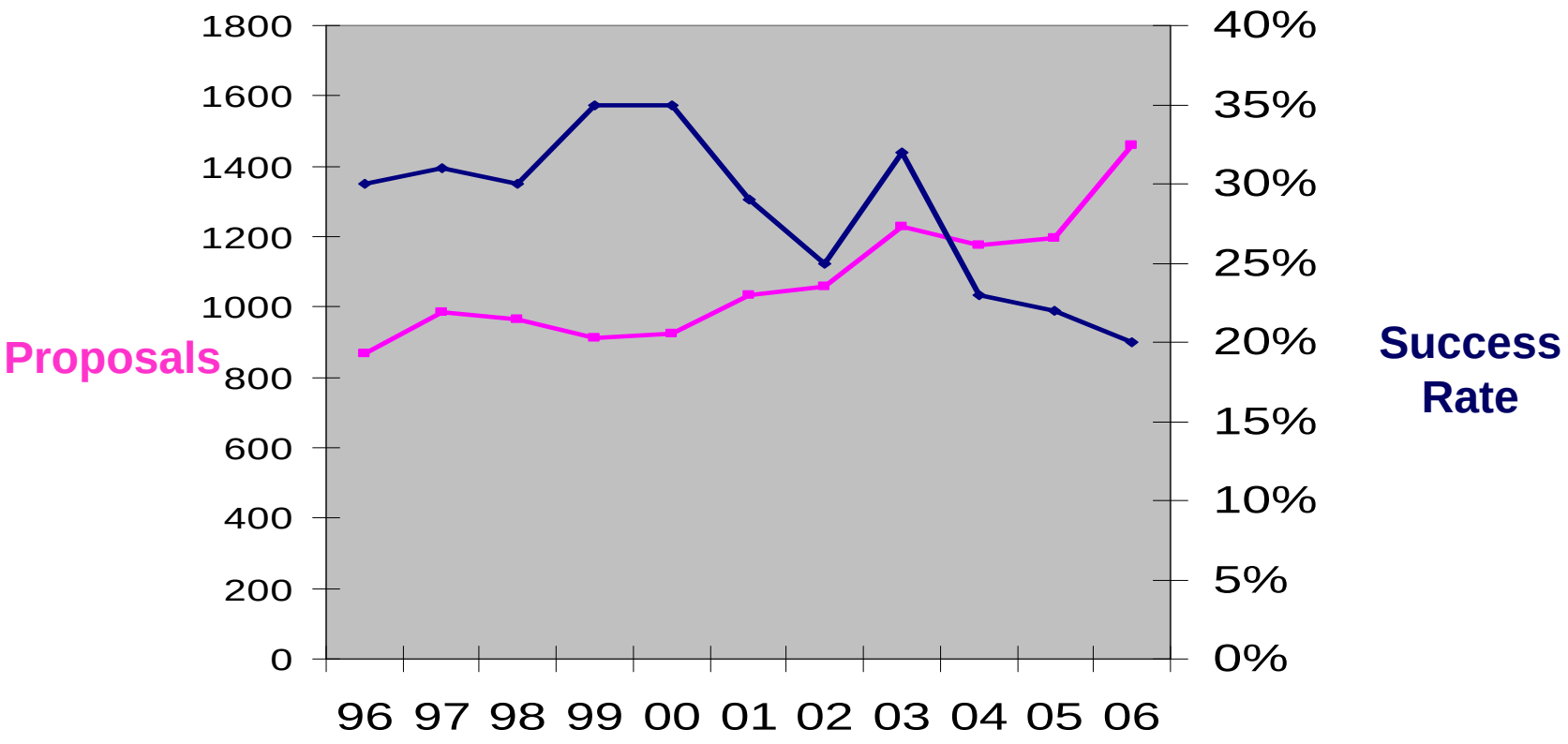
(including support from CHE, ENG, and others)

The DMR Community, FY 2006



And more than 5000 people used DMR-supported facilities in FY06

DMR Proposal Pressure & Success Rates (Research Grants)

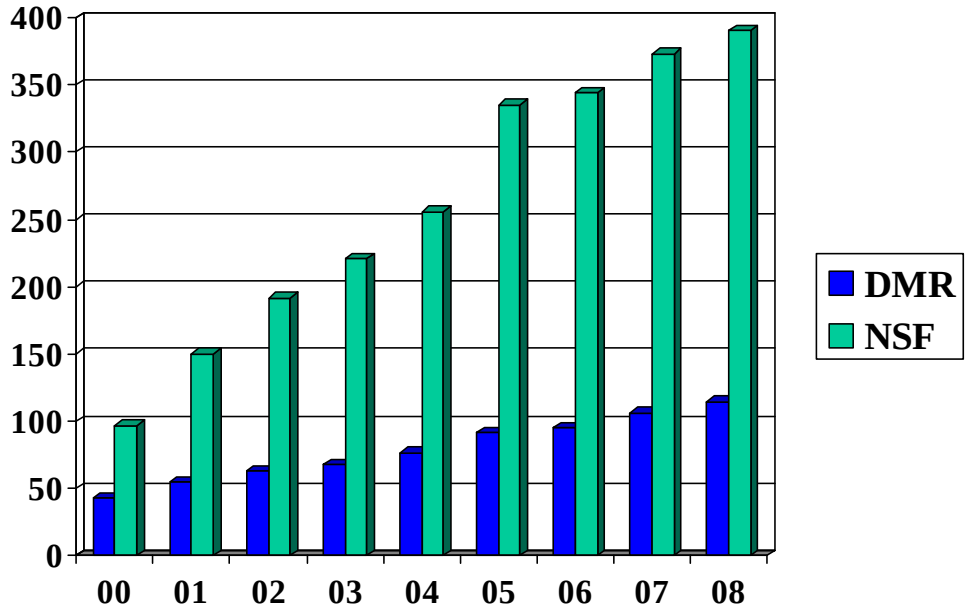


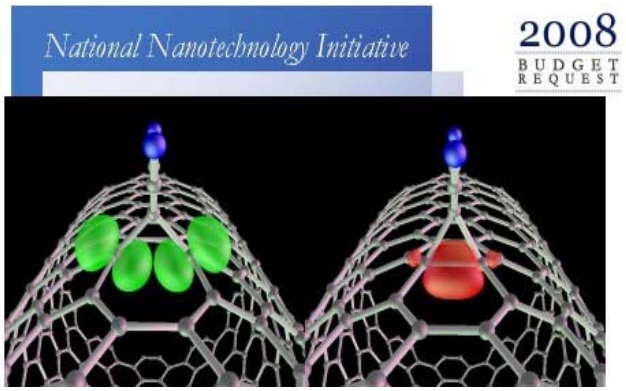
NSF Support for Nano

Wide Spectrum of Topics and Support Modes

Individuals, Groups, Centers, Networks, Facilities, Education, SBIR…

FY 08 *REQUEST* $380M (NSF), $114M (DMR)





Functionalized nanotubes

Marzari group, MIT

DMR support for nano is now mostly 'mainstreamed' via *unsolicited* proposals (individuals and groups); centers competition; or instrumentation & facilities

27 University-Based Centers, $1M - $4M per year

6-year awards with open competition every 3 years

68 Interdisciplinary Groups address almost all areas of materials research

Biomolecular and biomimetic materials, self-assembly

Coatings, ceramics

Condensed matter phenomena, highly correlated systems

Electronic and photonic materials

Magnetic materials, ferroelectrics

Nanostructured / mesostructured materials

Nonequilibrium phenomena

Organic systems, colloids, polymers, soft matter

Structural materials, metals, mechanics of materials

Surfaces and interfaces

Synthesis and processing

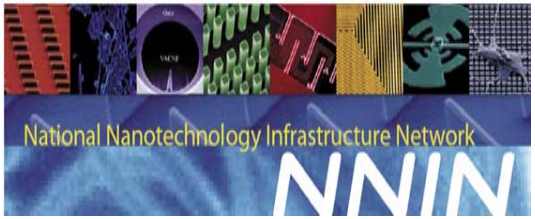
www.mrsec.org

Pre-proposals ~9/07

DMR National User Facilities

Stewardship for science and engineering research and education *ranging far beyond "materials"*

- **National High Magnetic Field Laboratory**
  - Florida State University, University of Florida, LANL
- **Neutron Facility**
  - CHRNS at the National Center for Neutron Science, NIST
- **Synchrotron Facilities**
  - CHESS at Cornell University
  - SRC at the University of Wisconsin
  - *University-based groups using DoE facilities*
- **National Nanotechnology Infrastructure Network**
  - 13 Universities
  - ***NSF-ENG lead***, plus DMR, CHE, BIO co-funding



*******MPSAC panel on NSF role in future light source facilities*******

Some New DMR Activities

- Biomaterials Program
- Partnerships for Research and Education in Materials (PREM)
- Materials World Network
- Mid-scale Instrumentation

"Strange Matter" at Liberty Science Center

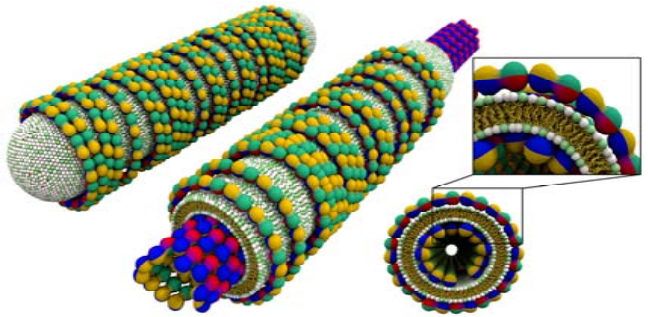
New DMR program in Biomaterials

Full implementation in FY 2007

The frontier with “bio” is an increasingly important area for DMR – a new program provides a clear focus for individual investigator and small group experimental research

The study of biologically-related materials and phenomena, including biological pathways to new materials.

Materials and systems of interest include biomolecules, biomolecular assemblies, biomolecular systems, and biomimetic, bioinspired, or biocompatible materials. The methods of materials research may be applied to biological systems to discover or understand phenomena and to create or optimize materials.



Cyrus Safinya - UCSB

Materials World Network NSF 06-590

The primary goal is to enhance international collaboration in materials research, education and technology

Since 2001 ~800 NSF proposals, 130 awards, $50.2M

Map shows partnership-funded collaborations in 2006

International Materials Institutes are developing partnerships that include Asia and Africa…

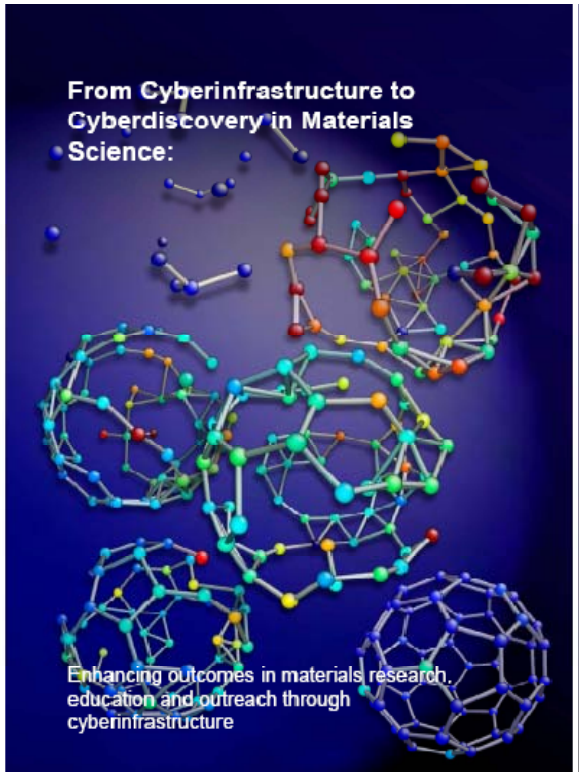
FY 08 DMR Intellectual Focus Areas

- ***Via 'core' programs wherever possible***
- Nanoscale materials and phenomena
- Complex systems including *biomaterials*
- Computational discovery and innovation
- Fundamental research addressing "science beyond Moore's Law"
- ***And expect the unexpected!***

Education is integrated throughout

Cyber-enabled Discovery and Innovation

It's a 2-way street: " Materials enable CI" *and*
"CI will have an enormous impact on the way we do research"



Read the report and post comments at
www.mcc.uiuc.edu/nsf/ciw_2006/

Thank you!

http://www.nsf.gov/materials

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Writing Effective (NSF) Proposals in Materials Research

David L. Nelson
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NSF invests in the best ideas from the most capable people, determined by competitive merit review

Merit Review Criteria

- *Intellectual Merit*

  Importance of proposed activity, creative & original, qualification, past work, resources

- *Broader Impacts*

  Advance discovery while promoting teaching & training, broaden participation, enhance infrastructure for research & education, dissemination, benefit to society

National Science Foundation

Things to Consider

- **Why do it?**
- **Why you and not someone else?**
  - *Uniqueness of research, educational opportunities, available facilities...*
- **What are your strengths?**
  - *If you don't say it in the summary, will the reviewer bother to read on?*
- ***You*** **must convince the reviewer that you are worthy of funding**
- **Express yourself clearly**
  - *It's not the reviewer's job to figure out what you are trying to accomplish and why*

Your Proposal

Find a home and develop a strategy

- **The right reviewing community is important**
  - Where are your scientific peers funded?
  - Who knows your research / research you want to do?
    - ***Good advice to you***
    - ***Good advice to NSF***
  - Fastest way to funding / fewest proposals
- **The NSF Website and Fastlane: an important resource**
  - Information on funding opportunities
  - Locate your scientific peers – who funds them?
  - Proposal submission, review submission, and award management
  - Information on what's supported, who's supported, and where
  - ***Deadlines and "windows" for proposal submission***

Your Proposal - Some Issues

- Best fit of your research onto NSF programs
  - *Multiple programs: what's the main focus of the research?*
  - *Parts of the work more appropriate for other programs*
    e.g. MRI for instrumentation
- Relationship to other support
  - *Centers, groups, ONR, DOE, DARPA, NIH…*
  - *It must be clear what <u>this</u> grant will support ("one project, one grant")*
- ***Before you submit a proposal***

talk to the Program Director

Good Practice

- Follow the Grant Proposal Guide
  - Proposal Format

    References, synergistic activities, Advisors/Advisees, other support, conflicts of Interests
  - Penalty => ***Return without review!***
- Suggest appropriate reviewers
  - Or even 'inappropriate' reviewers

Good Practice

- **Write to the review criteria**
  - Intellectual Merit
  - Broader Impacts

    => **Project Summary !**
- **Proposal solicitation = *Write to the solicitation***

  e.g. CAREER, nano, instrumentation, REU...
  - Additional review criteria specified in solicitation
- **What resources are needed to carry out the work?**
  - Honest assessment of what you need to do the work
  - What other support you have?
- **Set your proposal in context**
  - What has already been done, by you ***and by others***?

Good Practice

- **Submit proposals on time**
  - **Target date, submission window, or deadline?**
  - **DMR Renewals**: must meet the submission window
- **Don't submit the same proposal more than once!**
- **Don't write a flurry of proposals**
  - Establish your research program first
  - Respond to Solicitations with care …
  - You won't be reviewing …
- **Reviewer experience – volunteer!**

Outcome

Award – congratulations!

- **Read the reviews**

  may want to adjust your plans
- **Goal is excellent science and education!**
- **File annual progress reports on time**

  whether you expect a funding increment or not
- **Send NSF Highlight slides when requested**

  important no matter what kind of research you do
- **Tell us *immediately* about achievements and high profile publications**

  at least 2 weeks prior to their journal appearance

Thank you!

http://www.nsf.gov/materials

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