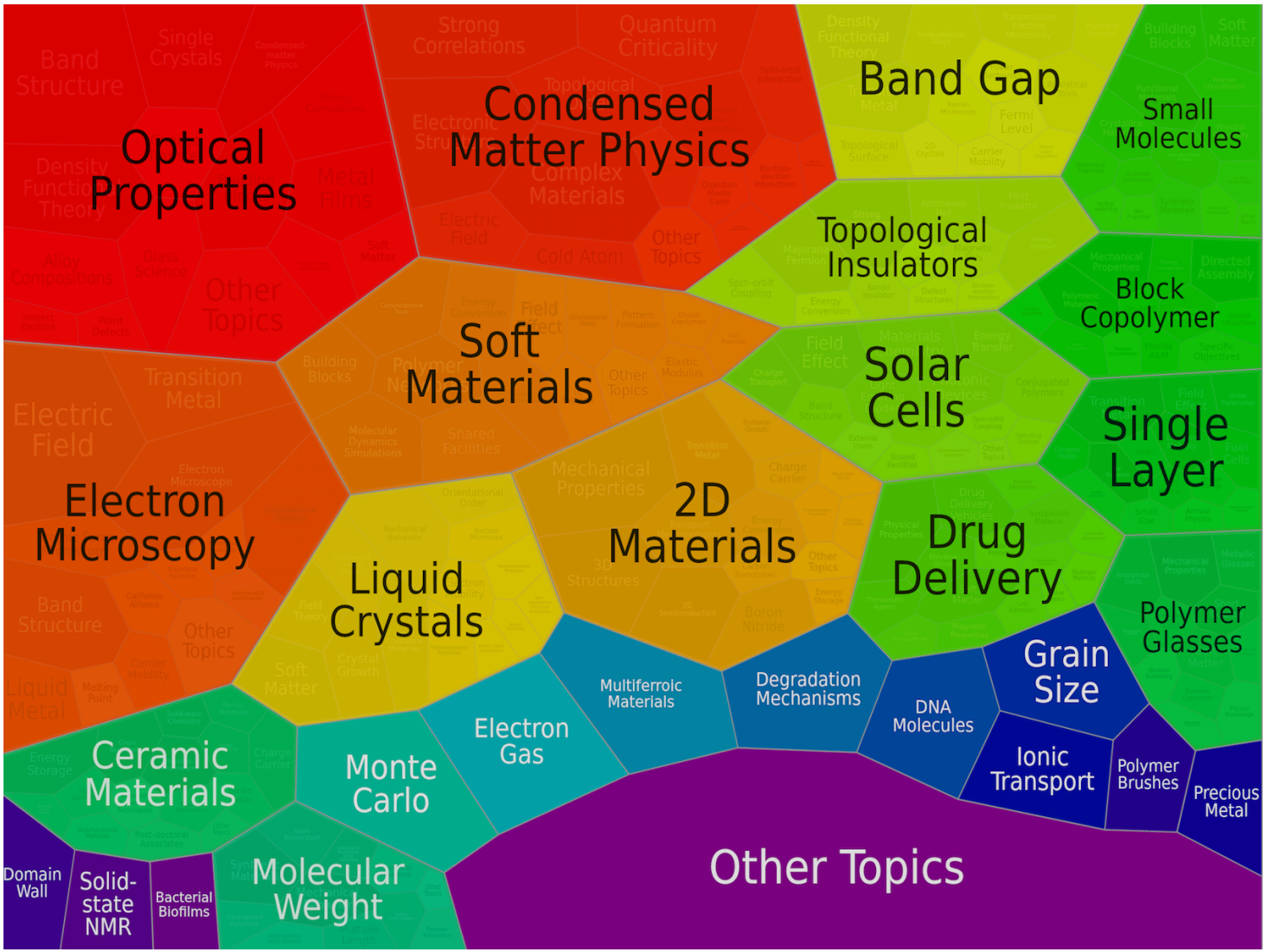
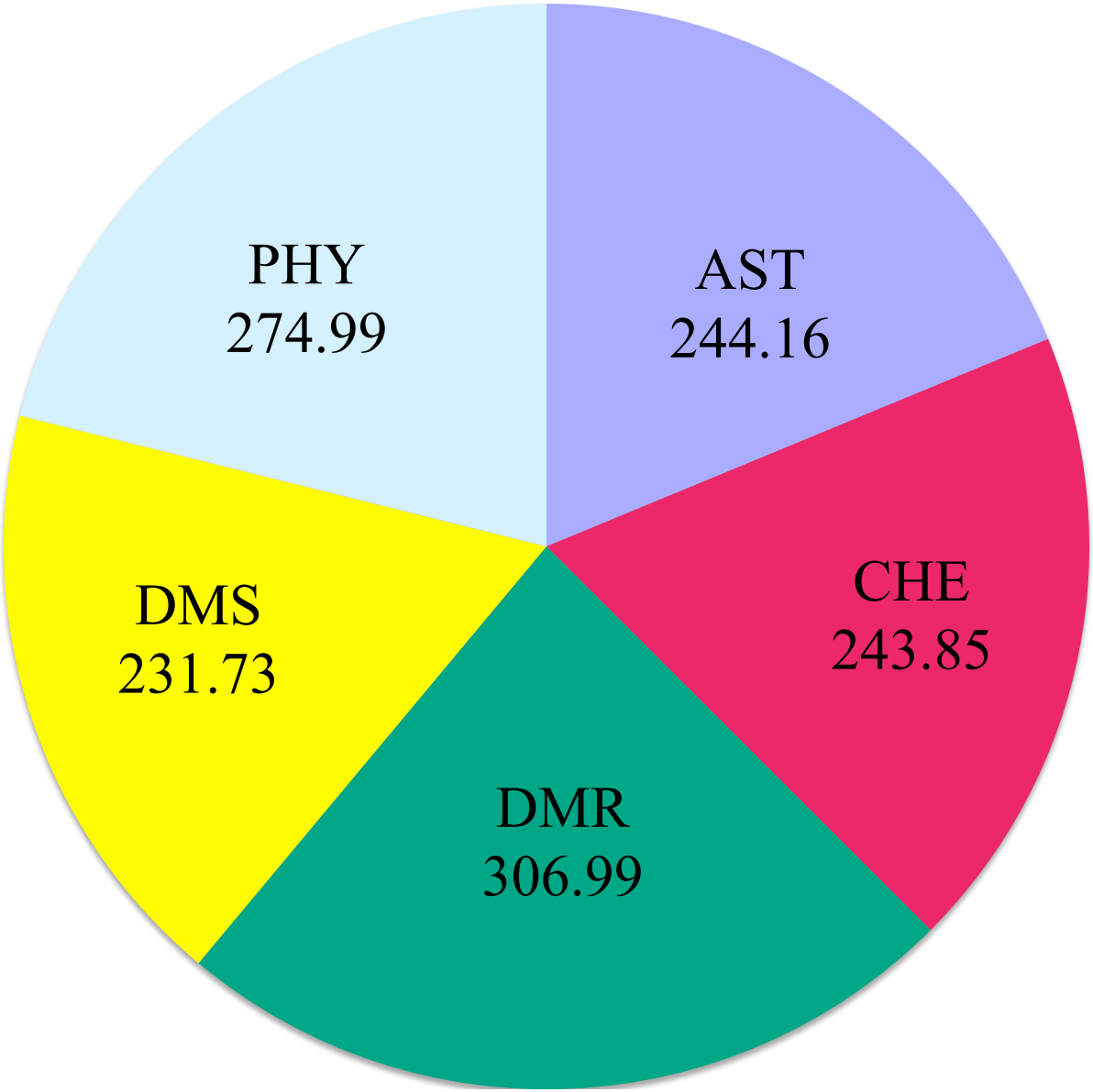
Division of Material Research (DMR)

Mary Galvin - Division Director



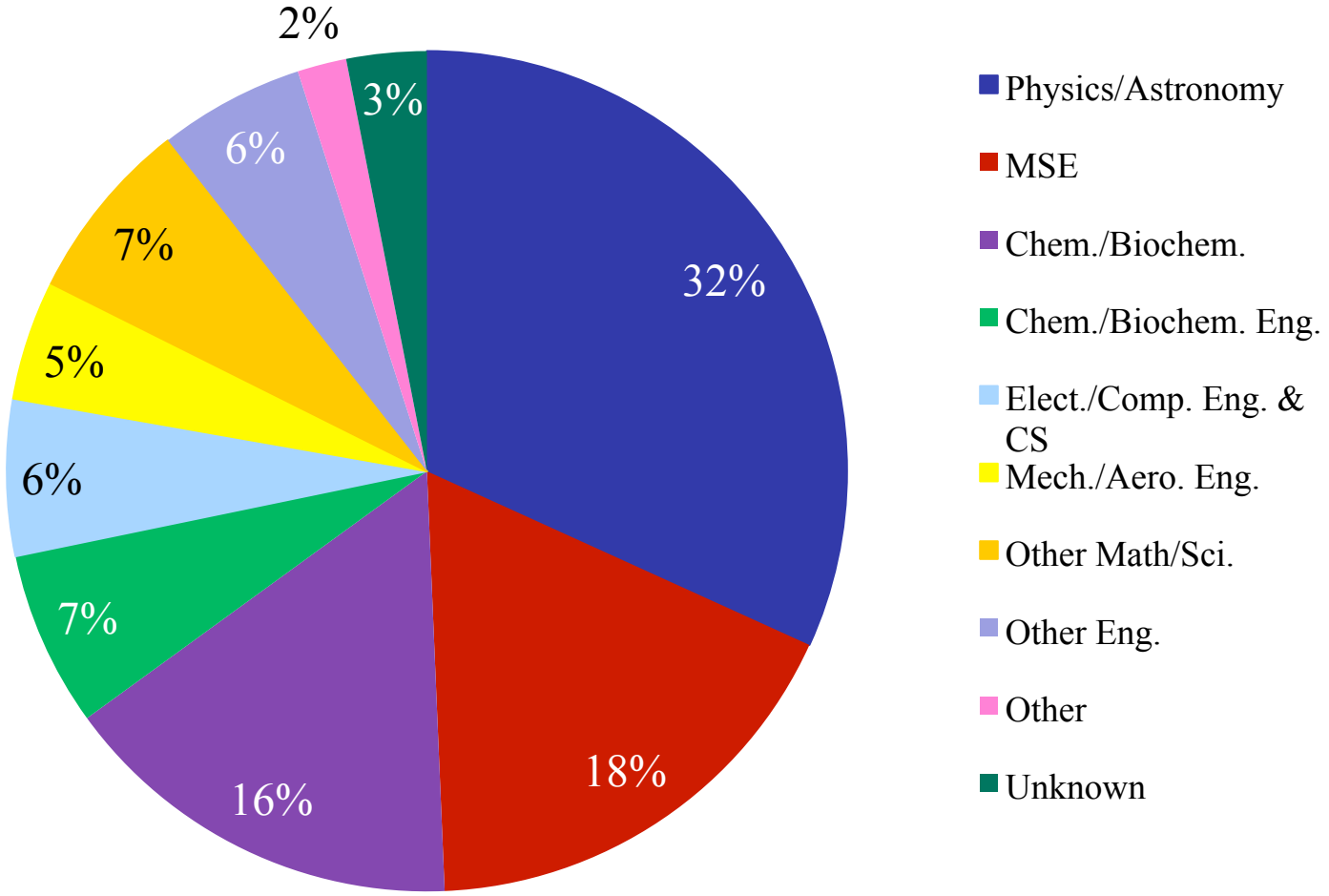
From Project Summary of FY 14 Awards

MPS FY15 Budget Estimate



$ in millions

PI Distribution DMR

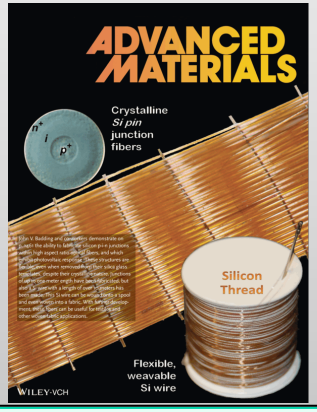


But diverse as they are, materials scientists look at materials from a unified point of view: they look for connections between the underlying ***structure*** *of a material, its* ***properties****, how* ***processing*** *changes it, and what the material can do - its* ***performance***. (From Strange Matter)

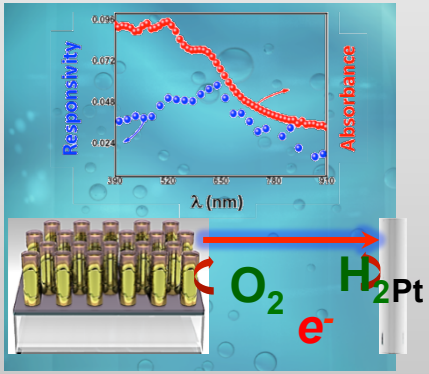
DMR Research

ENERGY

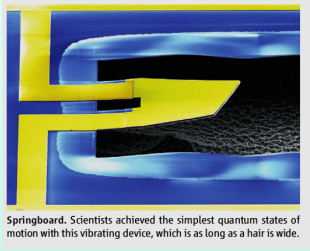
Flexible Si solar cell fabrics, John Badding, Penn State, EPM & MRSEC



Plasmonic Nanostructures for Solar Water Splitting, Stucky, UCSB, SSMC

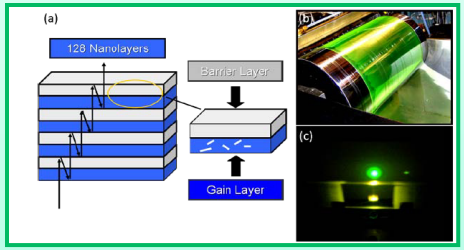


Future Electronics/Photonics


Springboard. Scientists achieved the simplest quantum states of motion with this vibrating device, which is as long as a hair is wide.

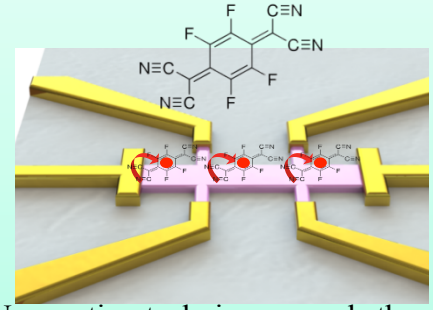
First device of this size to exhibit quantum behavior – absorb energy in discrete units, always moving and be in two places at once. Cleland, UCSB, CMP

STC Layered Polymeric Systems

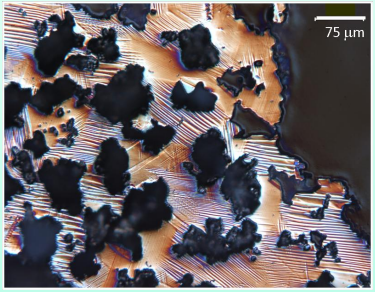


Company just spun off: Multilayer distributed feedback lasers and terabyte optical data storage, Case Western

Complex Phenomena



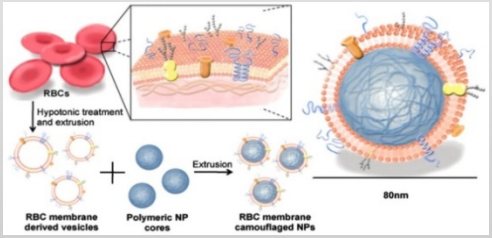
New gating technique reveals the conducting surface of a topological insulator, Bi_2Se_3 bulk charges removed with F4TCNQ to reveal surface conduction in TI. Fuhrer, U MD, EPM

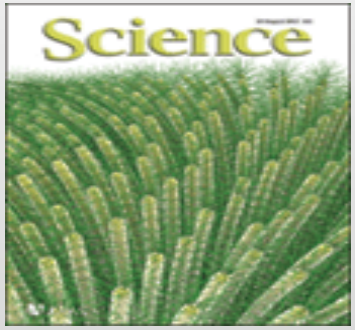


Ni-Mn-Ga alloy foam. Magnetic shape memory alloys exhibit strains of ~ 9% compared to 0.1 % , Mullner, Boise State, MMN

Health and Environment

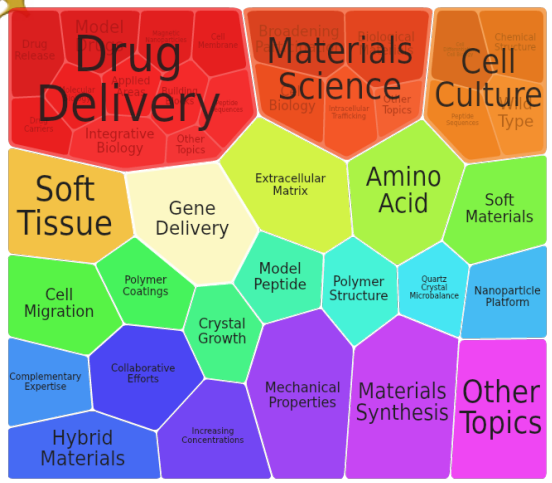
Stealth Vectors -Schematic for the preparation of RBC-membrane-coated PLGA nanoparticles (NPs), Liangfang Zhang, UCSD BMAT





Rubenstein, UNC, shown how dense mucopolysaccharides prevent mucous penetration – allow lungs to clear Infectious and toxic agents. CMMT

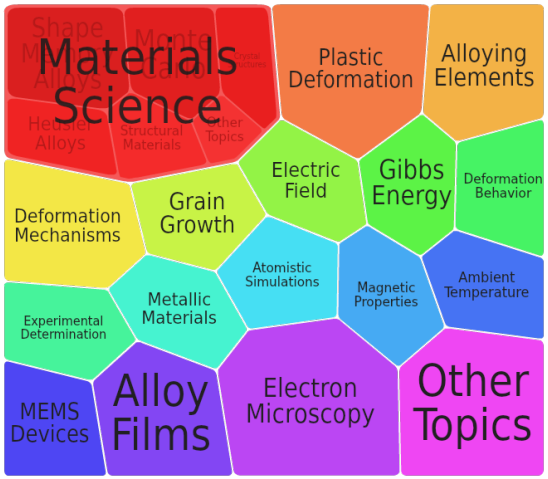
Material



BMAT

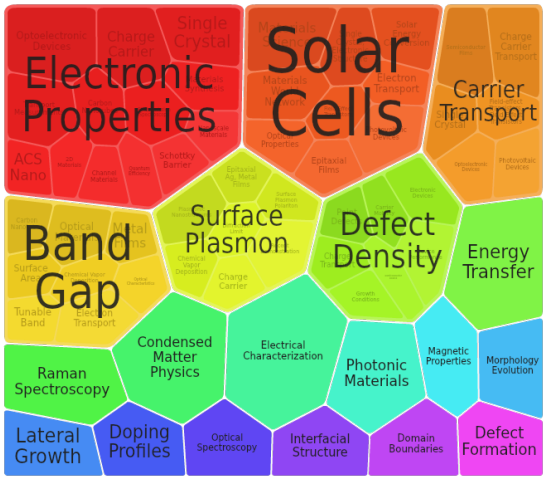
Joseph Akkara

Alex L Simonian



MMN

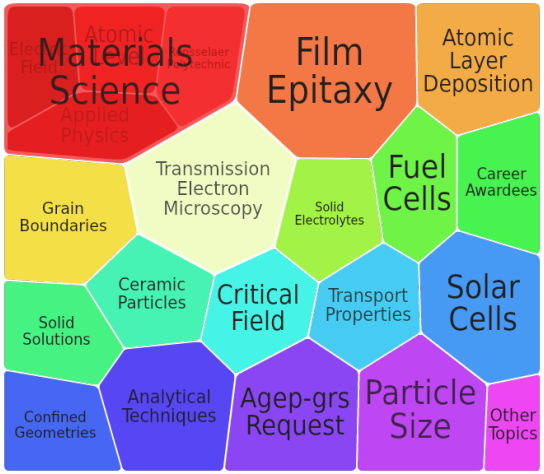
Gary Shiflet



EPM

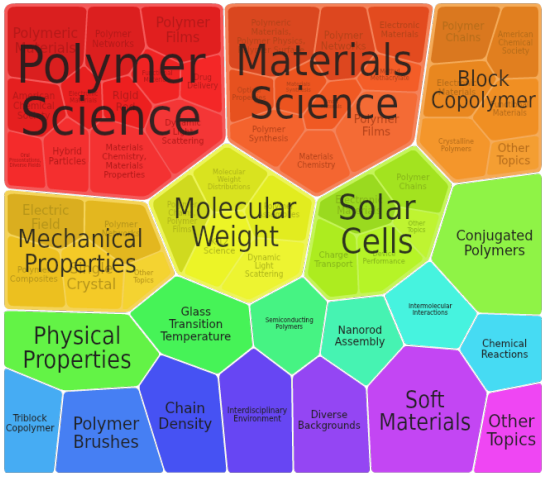
Charles Ying

Haiyan Wang



CER

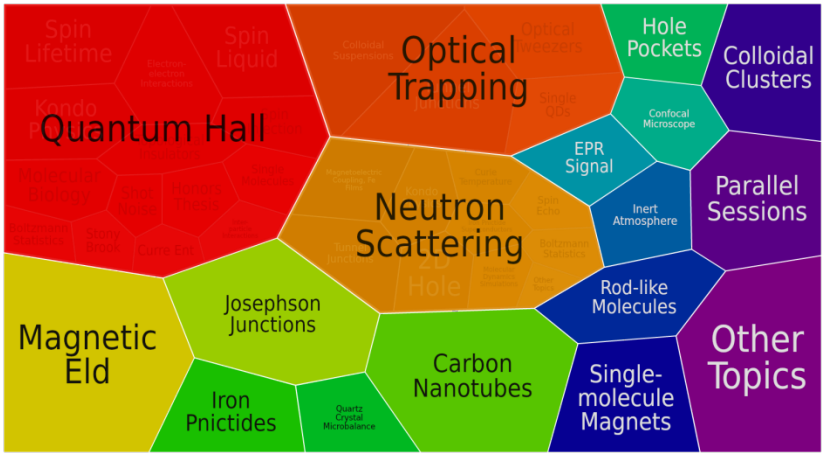
Lynnette Madsen



POL

Andrew Lovinger

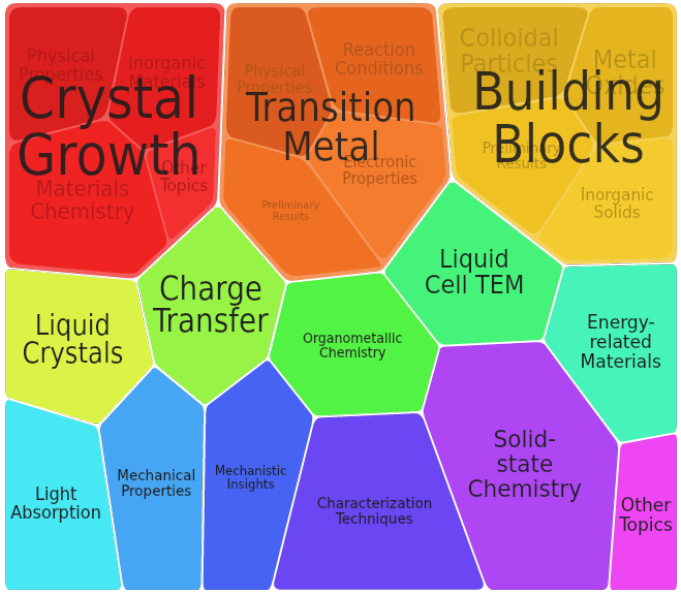
Discipline



CMP

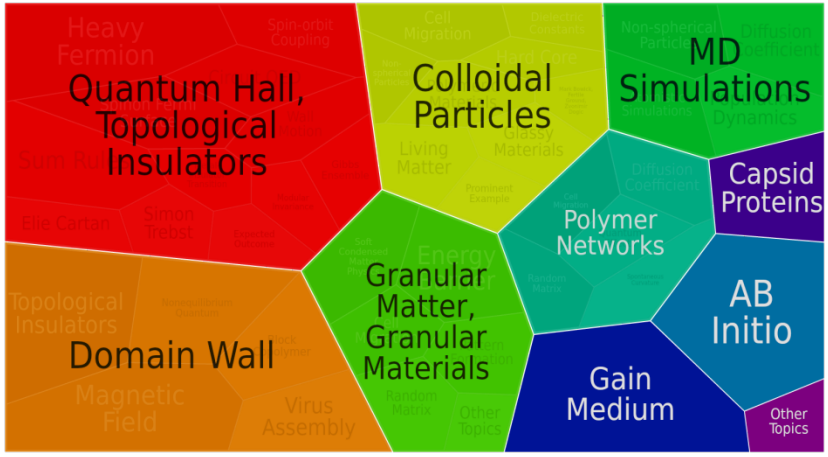
Tomasz A Durakiewicz

Paul Sokol



SSMC

Michael Scott



CMMT

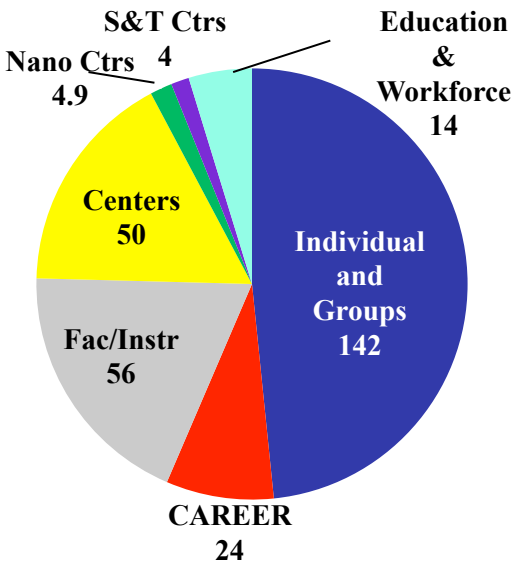
Daryl Hess

Serdar Ogut

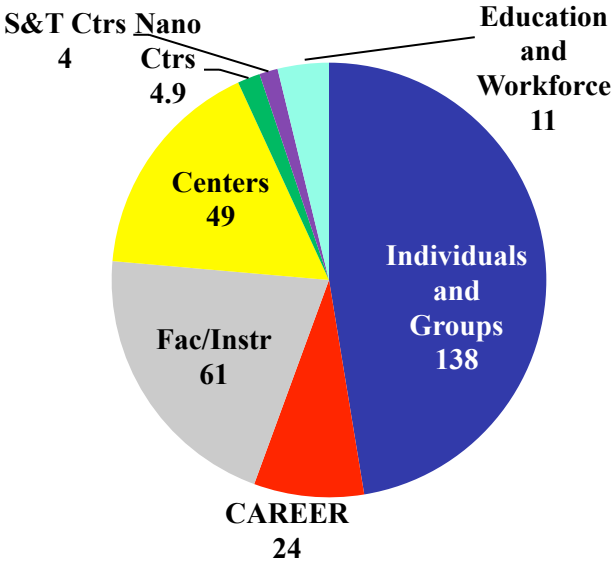
Andrey Dobrynin

DMR Budget

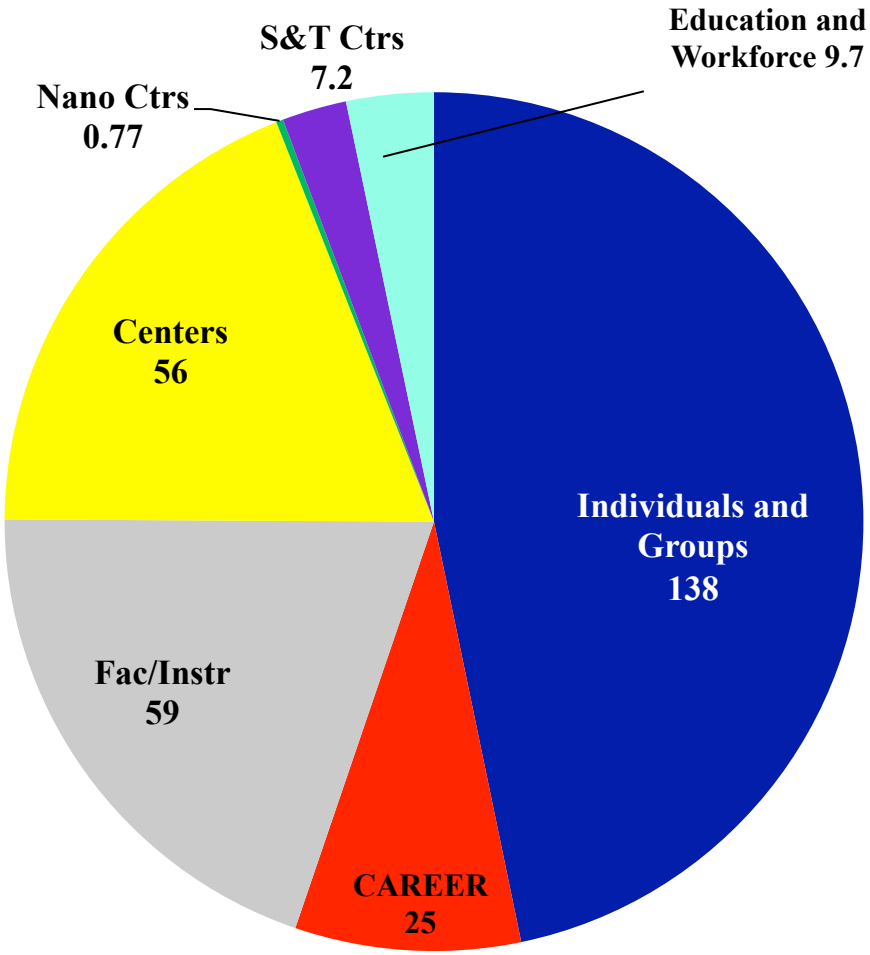
FY12: $295 M



FY13: $290.8 M



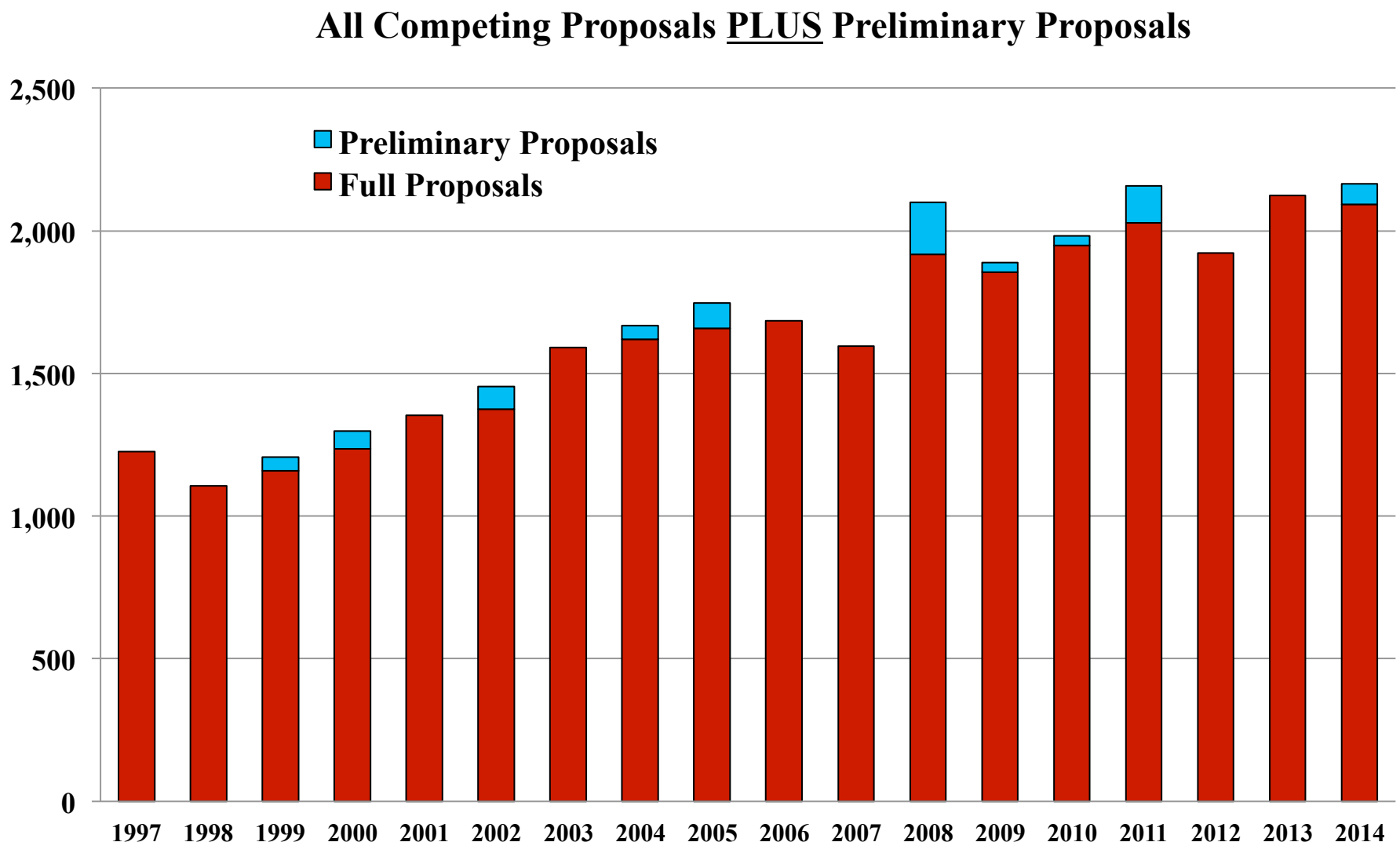
FY14: $295.7 M



FY15 Est. $306.99

FY16 R $315.8 (2.86%)

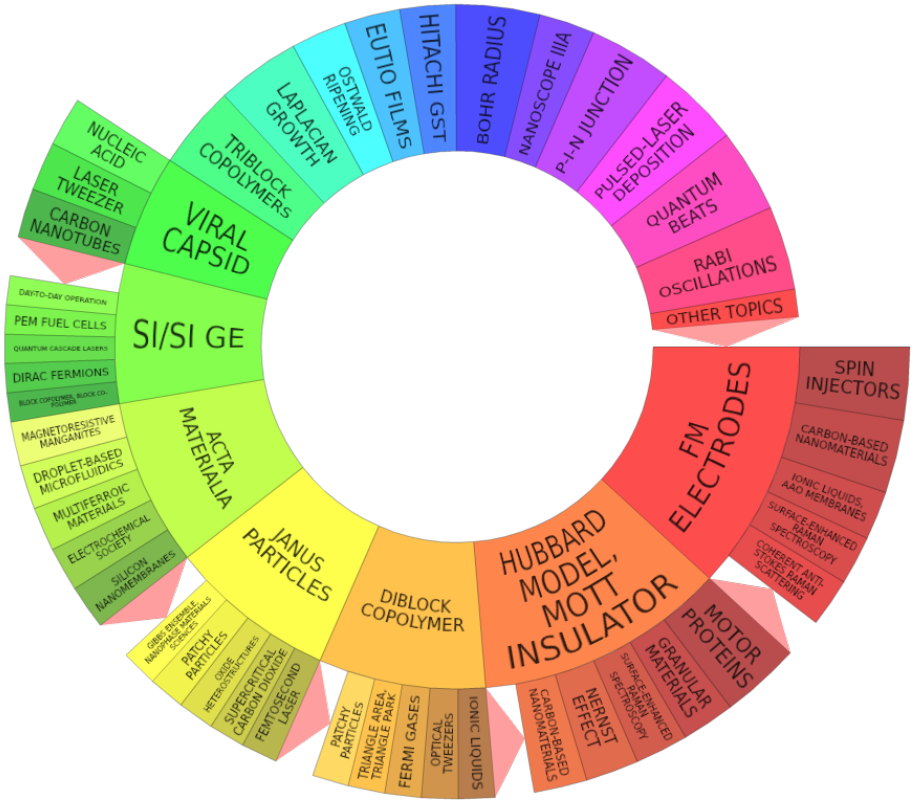
Proposal Pressure



Note that College costs increasing significantly faster than inflation

Materials Research Science & Engineering Centers (MRSECs)

- 1972 NSF established DMR with MRLs
- MRSECs must have 2 or more Interdisciplinary Groups (IRGs)
- Flexibility to develop new areas, support for ‘Seeds’
- Education and REU
- Shared experimental facilities
- Competition every 3 years – 6 year awards

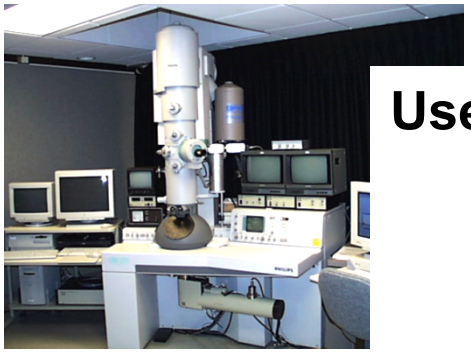


PO: Dan Finotello

MRSEC FY14 Competition

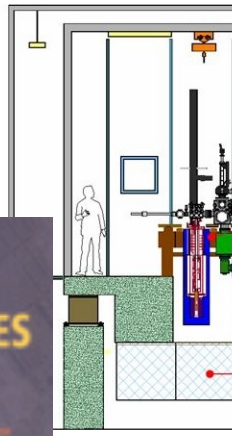
- 12 awards
- Columbia – new MRSEC – one IRG assembling materials from molecular clusters and another on 2D materials
- Three 1 IRG MRSECs went to 2 IRGs
  - Brandeis – new IRG materials for artificial muscles, self-pumping fluids and self-healing materials.
  - University of Colorado – new IRG new area that will use "thiol-ene click chemistry" to develop inexpensive synthetic analogs of DNA.
  - NYU – new IRG designer molecular crystals for pharmaceuticals, organic electronics and coatings.

Infrastructure



Users of MRSEC Facilities

> 2000/yr Academic
> 550/yr Industry
>100/yr National Labs



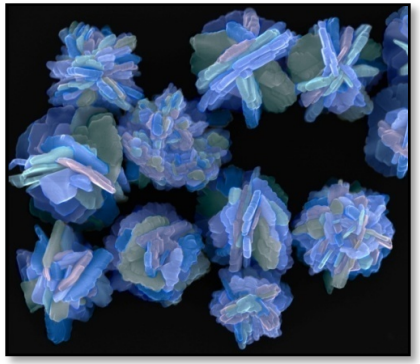
Over 500 Publications annually

Shared Facilities Workshop in 2011

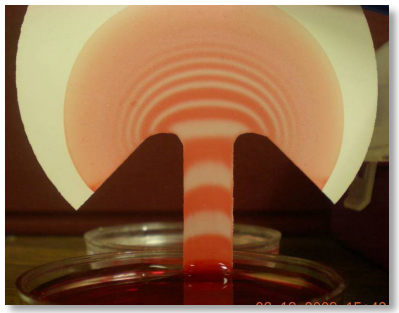
- 77 Technical Staff in SEFs
- 31 Other Technicians
- 70 Administrative Staff
- 28 Education Staff

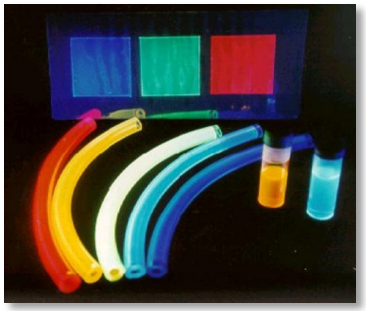
The Partnership for Research and Education in Materials (PREM) Program

… to address the pipeline of under-represented minority materials scientists…



The Division of Materials Research (DMR) seeks to broaden participation in materials research and education by stimulating the development of long-term, collaborative partnerships between minority serving institutions and DMR-supported groups, centers, institutes, and facilities.





Multidisciplinary User Facilities for Research

Stewardship: OMINaF Provides high cost and unique experimental capabilities to the DMR community.

- **Cornell High Energy Synchrotron Source**
- **National High Magnetic Field Laboratory**

Partnership: OMINaF partners with others to provide resources to the DMR community.

- With NIST: **The Center For High Resolution Neutron Scattering (CHRNS)** at the NIST Center for Neutron Research
- With DOE: **The Intermediate Energy X-Ray (IEX) beamline** 29-ID currently under construction at the **Advanced Photon Source**.
- With NSF/Chem: **ChemMatCARS Beamline** at the Advanced Photon Source
- With NSF/ENG: National Nanotechnology Infrastructure Network (NNIN)

POs: Thomas Rieker, Tess Guebre, Sean Jones

Materials Innovation Platforms (MIP) Midscale Facilities

Research

- MIPs are centered around a focused *research team* of at least 3 senior investigators.
- MIP in-house research is transformational and *focused* on a targeted materials grand challenge and/or technological outcome of *national impact*.
- Achievable only through the *acquisition and development* of unique, state-of-the-art, mid-scale instrumentation – *national need for equipment*.
- New materials and materials phenomena are discovered where synthesis, characterization, and theory/modeling are done in an *iterative and "closed-loop"* manner. (MGI)
- Synthesis, characterization, theory/modeling are equally weighted in a MIP and *advances are expected in each area*.

For further information:

NRC Report, *Frontiers in Crystalline Matter: From Discovery to Technology*

MPS Advisory Committee, *Closing the Loop*

Materials Innovation Platforms (MIP)

…establish focused research teams who substantially accelerate the discovery of new materials and phenomena through the access of unique and world class instrumentation which provide access to users nationwide.

- First solicitation - synthesis of bulk crystal and thin film hard materials.
  - Targeted area will change - workshops
- Could be co-located with a center or national facility.
- Five year award renewal for 5 years
- Start $6 M/year for 2 years and decrease to $2.5 M/year.
- Support Professional Staff

- Proposal deadline March 2, 2015.

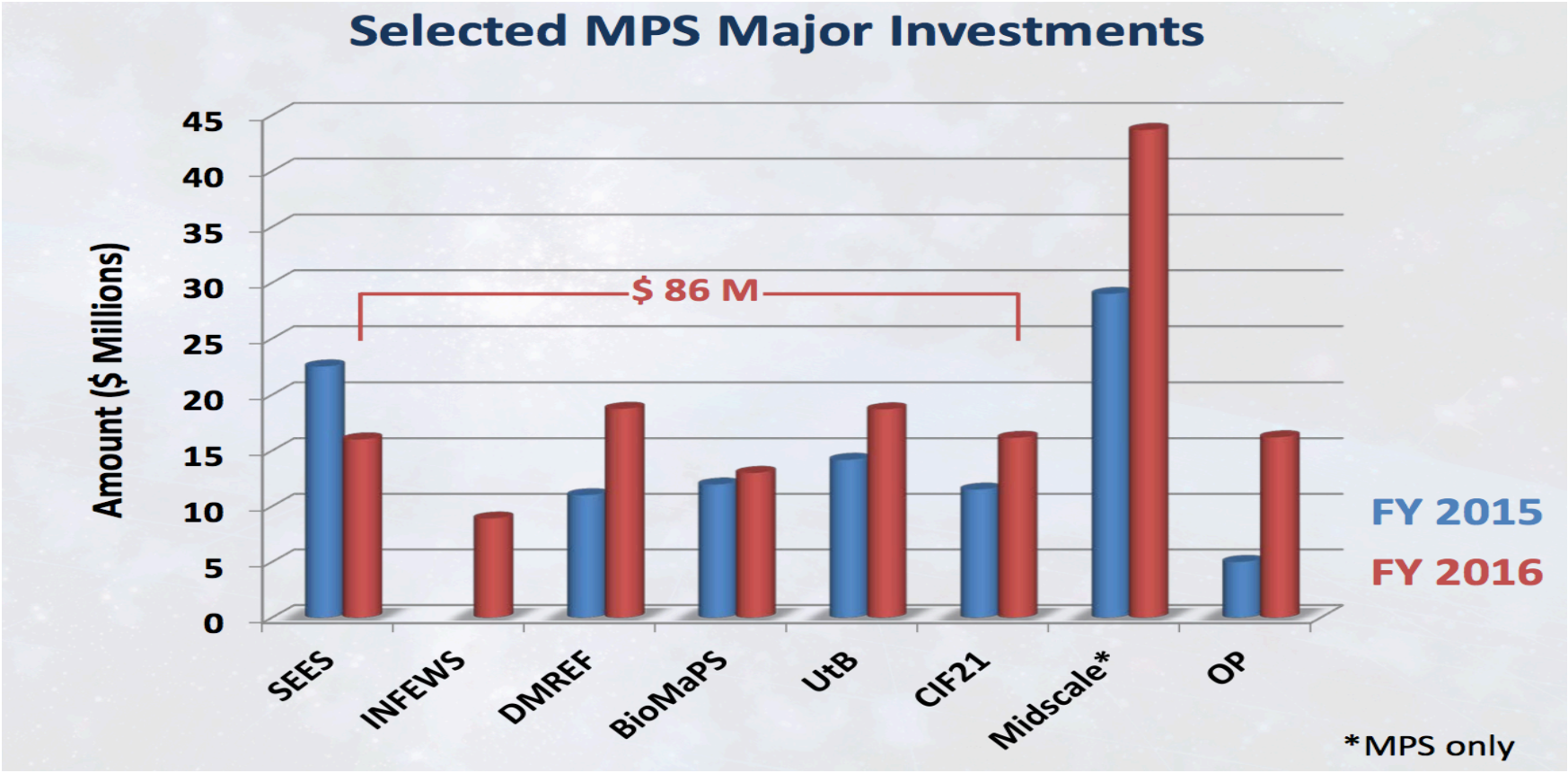
- http://www.nsf.gov/pubs/2015/nsf15522/nsf15522.htm

DMREF PROPOSALS - MGI

- New solicitation for FY15 – proposals due Jan 5 – Jan 29
  - http://www.nsf.gov/pubs/2014/nsf14591/nsf14591.htm
  - Limit PI can be on only 1 proposal
- NSF wide
  - MPS: DMR, CHE, DMS; ENG: CMMI, CBET, ECCS; CISE
  - **DMR PO: John Schlueter**
  - **ENG PO: Alexis Lewis**
- Must include - Materials synthesis/growth/processing, materials characterization/testing, and theory/data/computation/simulation components of the research.
- Must go beyond simple collaborations. – iterative feedback loop between all components.
- Want to see advances in all components of the project.
- Address open access to algorithms and data.
- Accelerate materials discovery (DMR) and development

- Awards have been to research groups. (Award size has gone to $1.6 M over 4 years)

Initiatives



Taken from MPS FY16 Budget Rollout

FY16 R for DMR

DMREF - $12.25M
BioMaPs - $3.24M
UtB - $3.8M
CIF21 - $2.65M
MIP - $12.48M

How you can help. Acknowledging your support from the Foundation

Support from the NSF must be appropriately acknowledged in all presentations and publications as well as web sites. **In publications must use NSF award number: DMR-XXXXXXX.**

Reporting work supported by multiple agencies or programs within NSF is accepted but the contribution from each funding agency must be acknowledged appropriately.

Centers, institutes and facilities need to display the program name, for example “MRSEC” , should appear on websites, publications, and presentations. The “brand name” must be featured prominently.

We need your support to ensure NSF DMR activities receive appropriate recognition

NSF uses academic rotators as Program Officers. If you are interested contact me or a Program Officer.

Questions

Thank You.