Preparing Competitive Research Proposals

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My Experience With Research Proposals

- During the last five years I have submitted >90 (50% as PI) research and education proposals, of which 48 (35 as PI) have been funded.
- Most of the competitive proposals submitted in my first two years were declined
- Examples of funded competitive proposals: CAREER (2nd attempt), NIRT (2nd attempt), MRI, Nanoscale Exploratory Research (3rd attempt), CREST (4th attempt), REU, unsolicited proposals, etc.
- I have evaluated over 200 research proposals for NSF, NIH, USDA, etc., most of which were evaluated in panels.

Who/What is a “Successful” Researcher?

- From my point of view (that of an academic):
  A successful researcher is one who advances the current state of knowledge/art in his/her field of research by
  - Performing research at the forefront of the chosen field
  - Disseminating the results of his/her research in the primary literature (i.e., peer-reviewed journal publications)
  - Training/educating new generations in how research is carried out and in the knowledge not available in the secondary literature (i.e., textbooks)

What does it take to be a successful researcher?

- Passion
- Discipline
- Creativity
- The “right” education
- “Good” students
- Access to adequate resources
- **Research funding!**

Why and How is Research Funded?

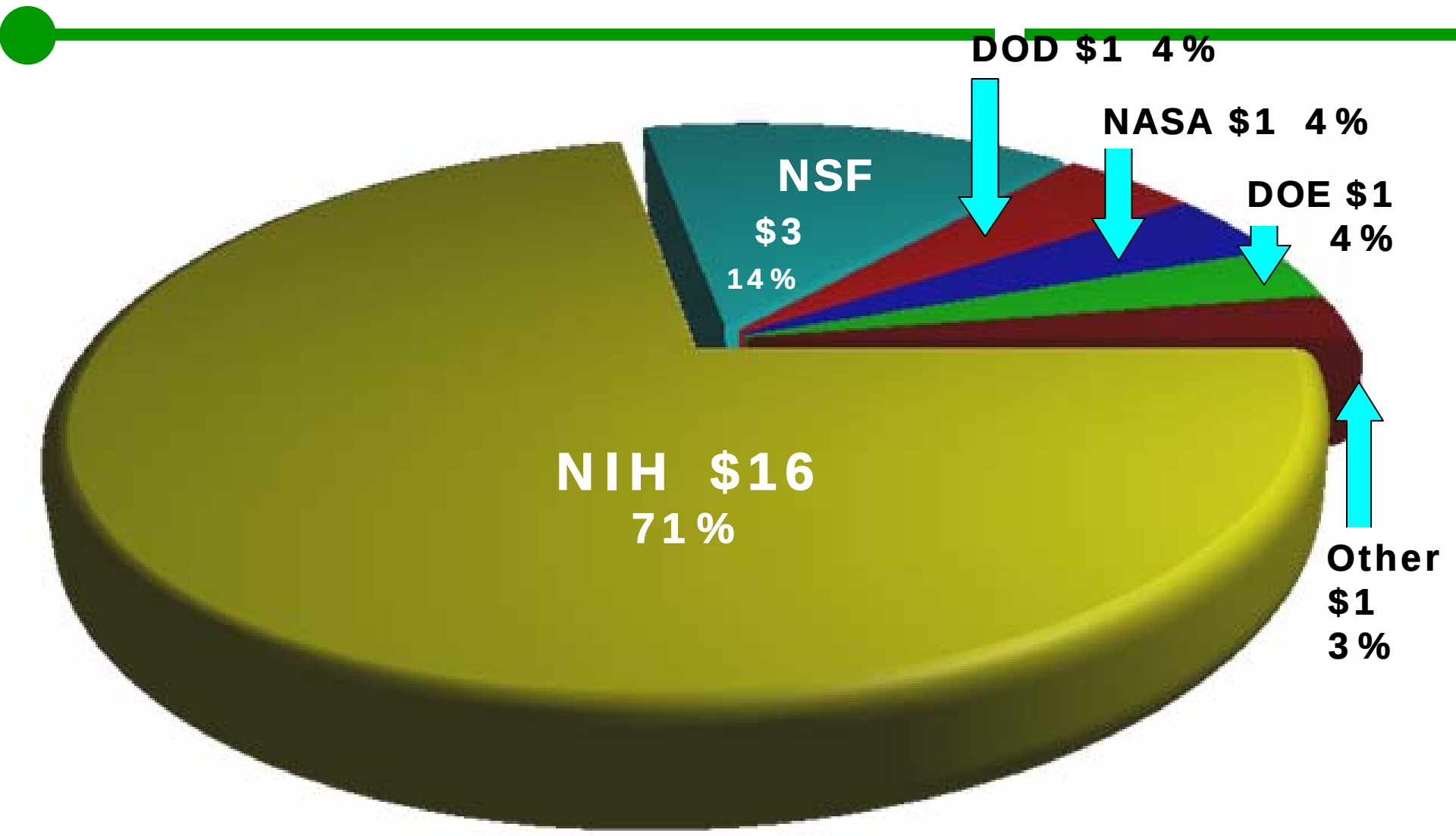
- The primary source of academic research funding in the US is the Federal Government
- The objectives of Federal Research Funding include:
  - The advancement of science and education in order to sustain national competitiveness (NSF)
  - The advancements of science and techniques to deal with human disease (NIH)
  - The achievement of strategic goals in space exploration, energy policy, national defense, etc. (NASA, DoE, DoD, etc.)
- Other sources of funding include:
  - Local government
  - Foundations and Funds (e.g., Merck Foundation, Petroleum Research Fund, etc.)
  - Private industry (difficult to get!)
- These alternate sources of funding have particular goals which shape their funded research portfolio

Who Benefits from Research Funding

- The following are the obvious stakeholders in Research Funding:
  - Students – typically receive some form of support in carrying out their studies
  - Faculty – receive extra pay and recognition
  - Universities – prestige and indirect costs (revenue)
- However, the most important stakeholder is the average citizen on the street – if research funding ultimately does not impact society as a whole then eventually the government will stop sponsoring research!
  - This is the motivation behind the NSF's Broader Impact criterion to be discussed later

Federal Academic S&E Support

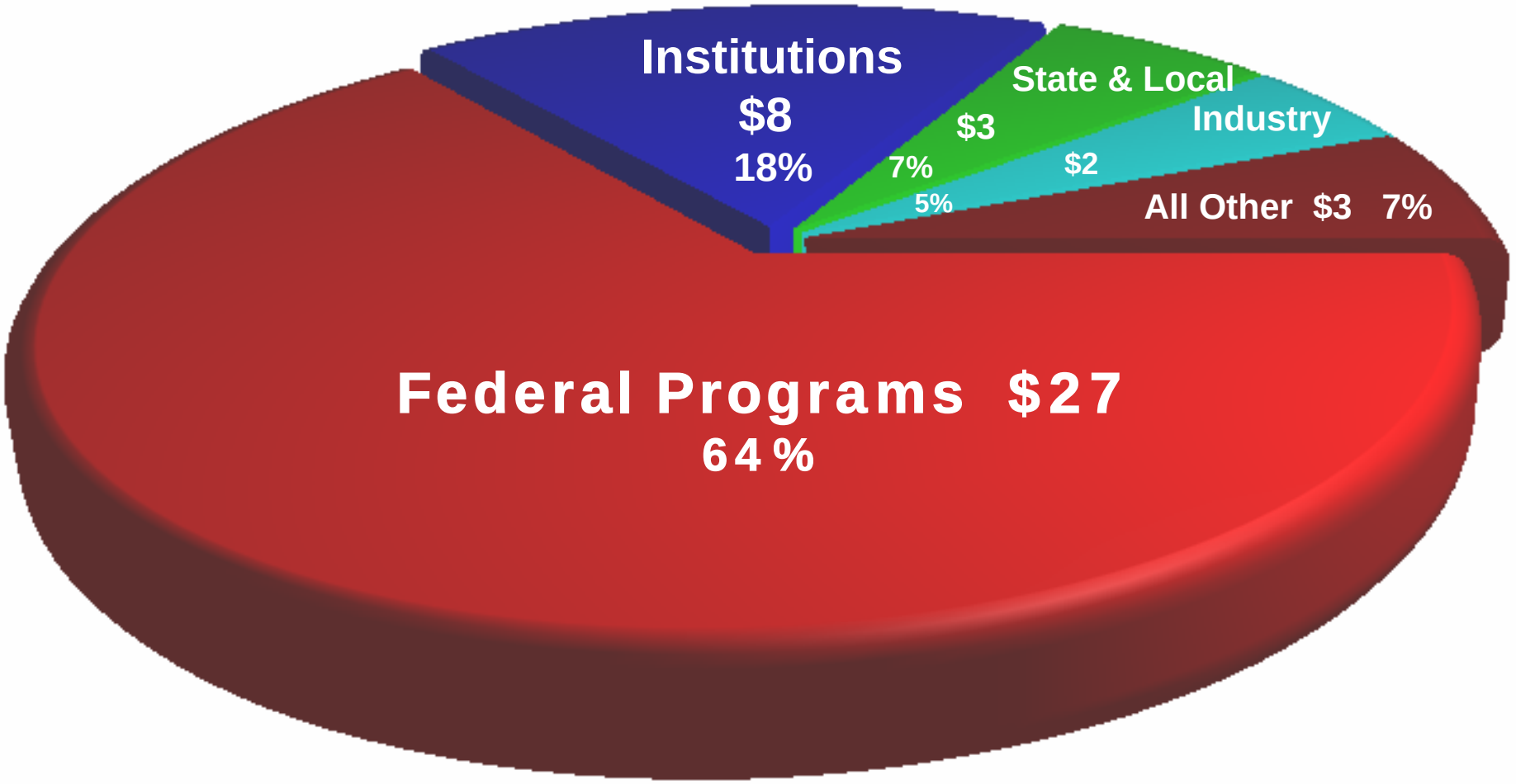
FY 2005 $22.4 Billion Total (Dollars in Billions)



http://www.nsf.gov/statistics/nsf06313/pdf/tables.pdf Table 59

R&D Funding Sources for Academic S&E

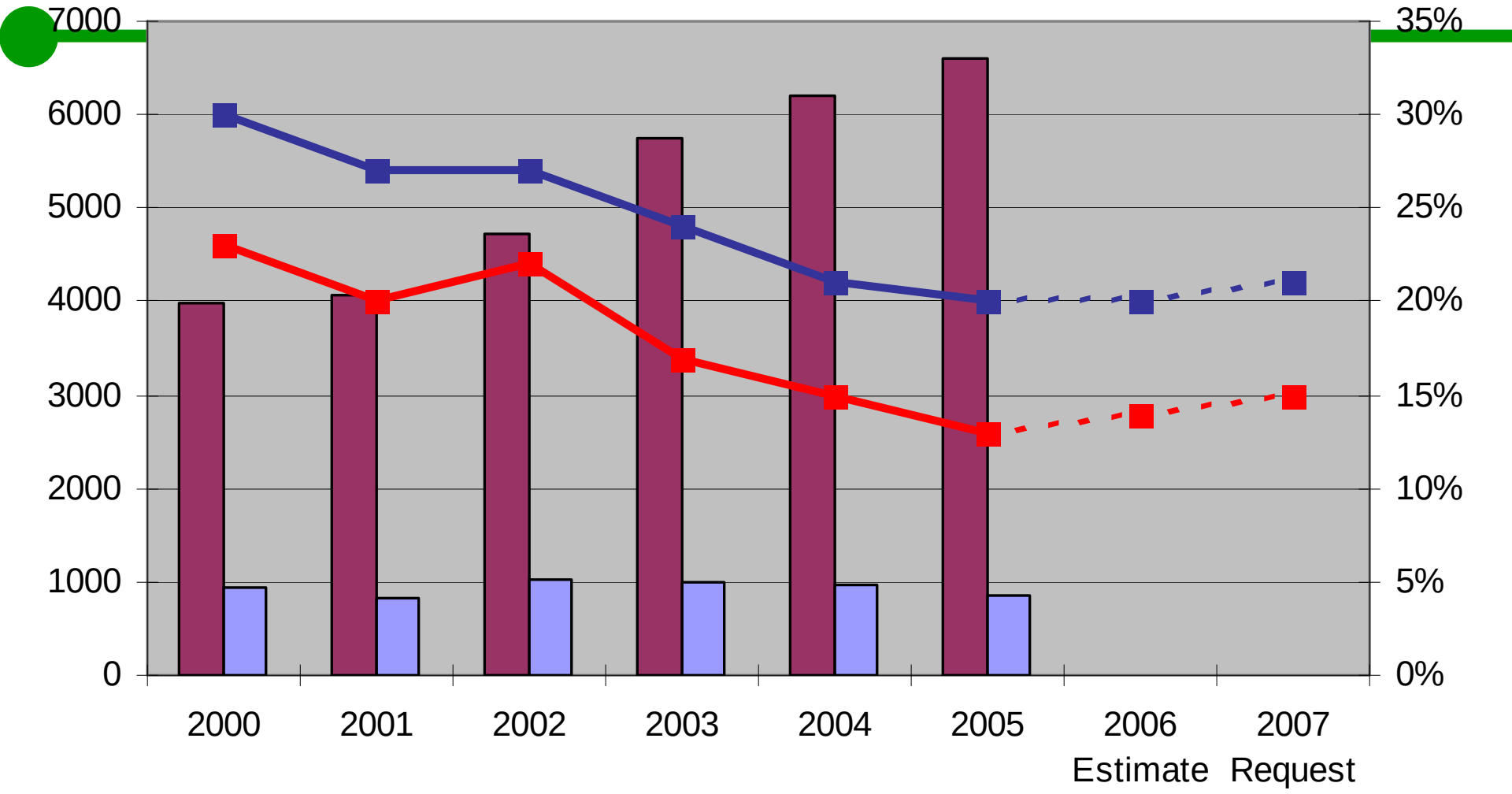
FY 2005 $43 Billion Total (Dollars in Billions)



http://www.nsf.gov/statistics/nsf06323/tables/tab4.xls

ENG and NSF Funding Rates

Research Grants



How to obtain research funding?

- Do your homework!
  - Get to know the major research funding agencies (NSF, NIH, DoD, DoE, NASA, DHS, etc.) as well as the smaller sources (ACS PRF, etc.)
  - Study the funding patterns of the agencies – what do they fund? How much?
  - Volunteer to serve as mail-in reviewer and in review panels (this is the future of proposal review)
  - Get to know your program manager(s) – discuss the research you plan to do with them, ask them for feedback, prepare whitepapers and pitch presentations

How to obtain research funding?

- Seek help!
  - R&D Center sponsored activities
  - Proposal Development Unit
  - Talk to successful colleagues (informal meetings, mentors, etc.)
  - Attend workshops sponsored by funding agencies
  - Buy books (e.g., Grant Writers Seminars and Worskshops)

How to obtain research funding?

- Submit as many proposals as you can, within intellectual and ethical constraints
- **Do not** focus solely on sheltered funds – EPSCoR is meant to stimulate competitive research, not replace it
- Take advantage of special programs for junior faculty (NSF BRIGE, NSF CAREER, NIH ESI, NIH Innovator, etc.)
- Similarly, do not focus (long term) on a single funding agency
- No proposal is too small – a little research funding is better than none!

How to obtain research funding?

- Plan your research for the next five years and divide projects into categories
  - Long term vs short
  - Applied vs fundamental
  - Based on your research ideas choose an overarching theme – this will be your niche
  - Distance yourself from your advisors, but do not stray outside of your area of expertise

Some sources of funding I have tapped (successfully)

- UPRM R&D Center Seed Funds ($10k)
- EPSCoR New Faculty Start-Up Funds ($250k)
- NSF Small Grant for Exploratory Research ($25k)
- NSF Major Research Instrumentation ($320k)
- NSF Unsolicited Proposal ($50k)
- NSF Nanoscale Exploratory Research ($56k)
- NASA IDEAS-ER ($70k)
- ACS Petroleum Research Fund ($35k)
- NSF CAREER ($421k)
- NSF Nanoscale Interdisciplinary Research Teams ($1.15M)
- NSF REU ($249k)
- NSF CREST ($5M)
- NSF PREM ($3.25M)
- NIH R15 ($225k)

Other sources of funding I tried (and failed)

- NSF Nanoscale Interdisciplinary Research Teams (failed the first, got the second!)
- NSF CAREER (failed the first, got the second!)
- DoD Research in HSIs
- NSF CREST (3 times! Got the 4th!)
- DoD EPSCoR
- Etc…