

Who is Funding Nanotechnology and How?

Evidence From Publication Analysis

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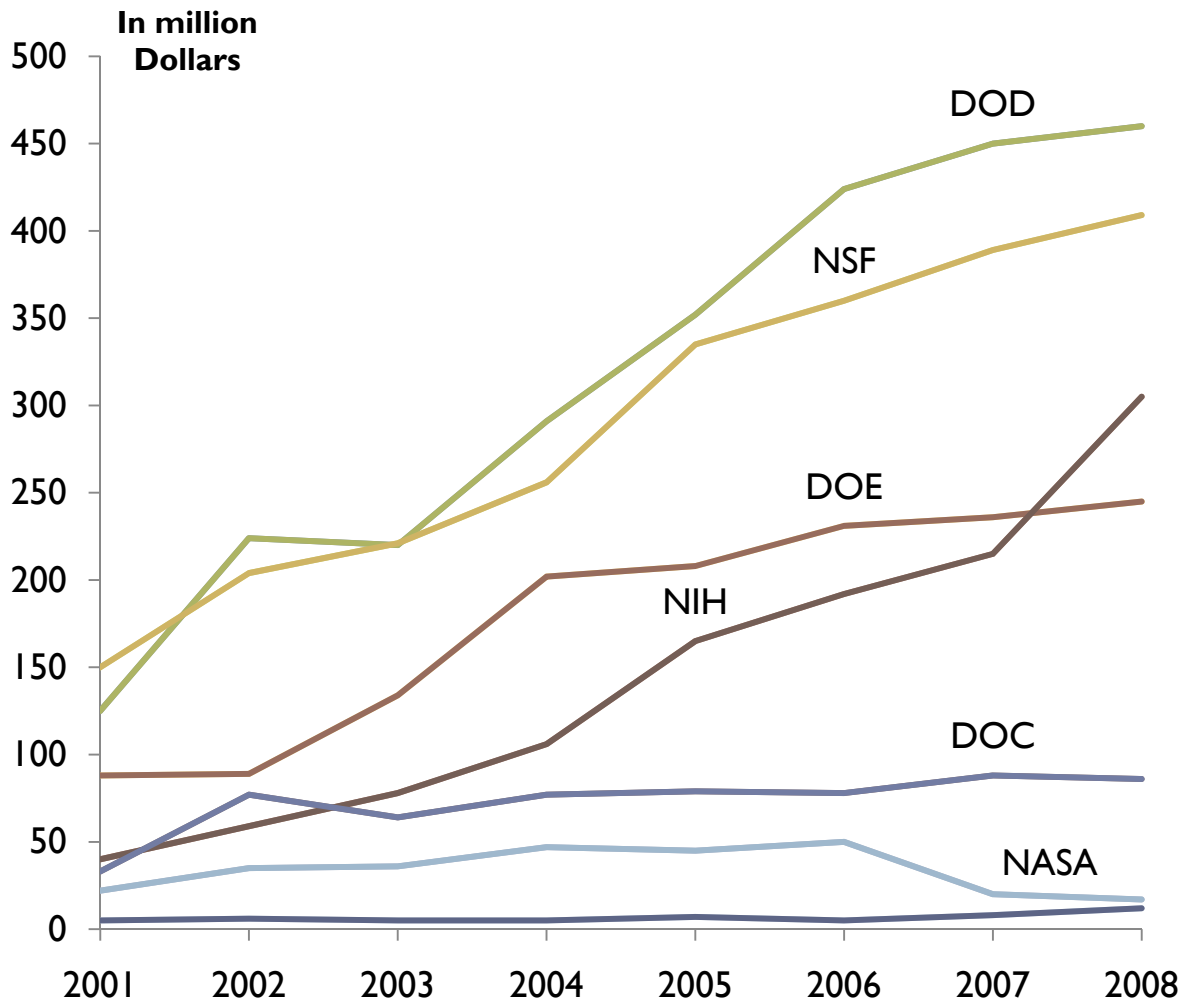
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Introduction

- ▶ **Nanotechnology research output in the U.S.**
 - ▶ 1/4 nano publications in the world (Youtie et al., 2008)
- ▶ **National Nanotechnology Initiative (NNI)**
 - ▶ Founded in 2001
 - ▶ Coordinating federal nanotechnology R&D
 - ▶ 25 federal agencies participating in NNI
 - ▶ 13 agencies providing R&D funding



Funding on nanotechnology



▶ Average annual growth rate

- ▶ DOD 23%
- ▶ NSF 16%
- ▶ DOE 17%
- ▶ NIH 34%
- ▶ DOC 21%
- ▶ NASA 3%
- ▶ EPA 18%

▶ Share

- ▶ DOD 30%
- ▶ NSF 28%
- ▶ DOC 17%
- ▶ NIH 14%
- ▶ DOC 7%
- ▶ NASA 3%
- ▶ EPA 1%

Major funding agencies

- ▶ **NSF**

- ▶ Fundamental research across all disciplines of science and engineering

- ▶ **DOD**

- ▶ Science and engineering research advancing defense and dual-use capabilities

- ▶ **DOE**

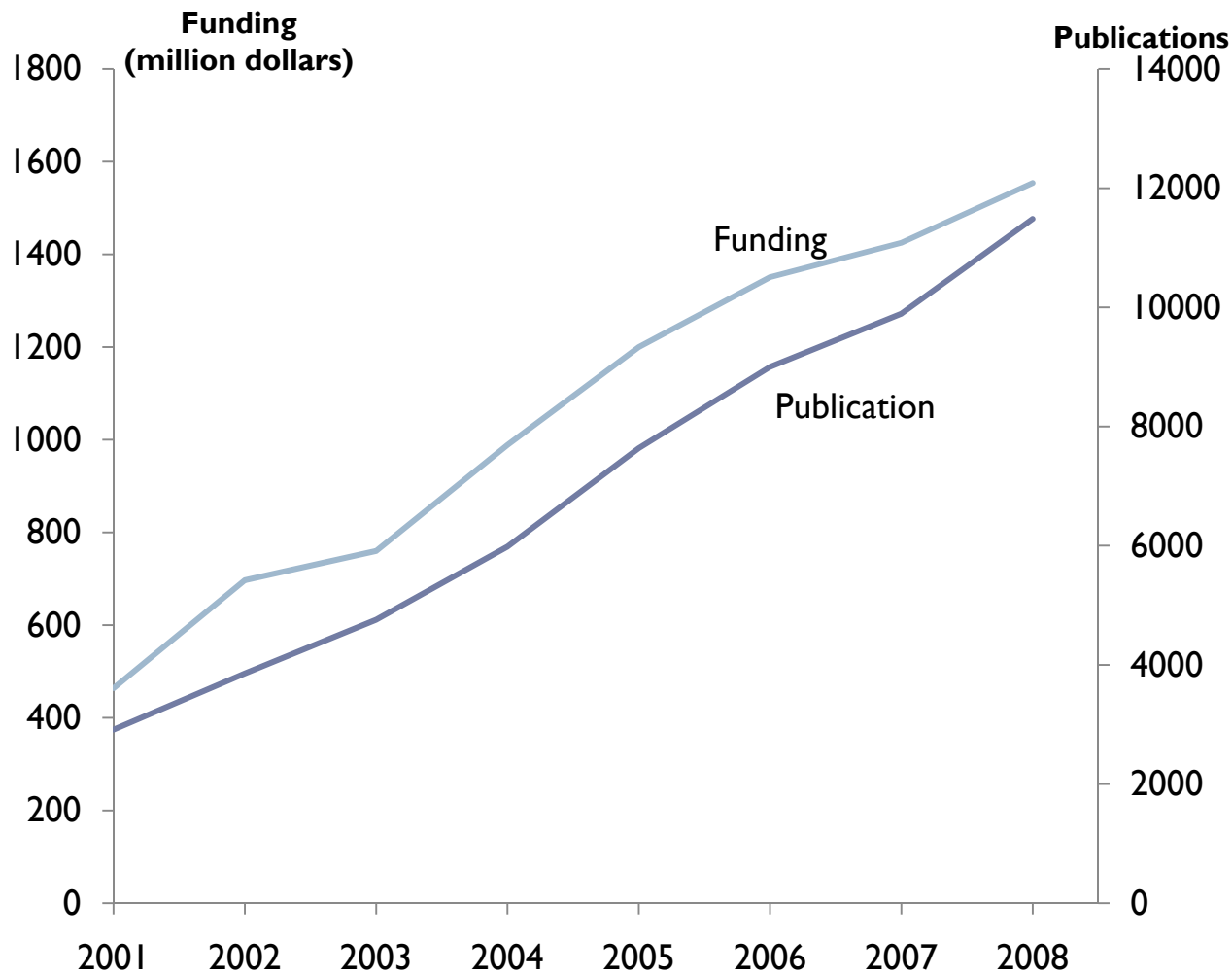
- ▶ Research providing a basis for new and improved energy technologies

- ▶ **NIH**

- ▶ Nanotechnology-based biomedical research at the intersection of life sciences and the physical sciences
-



NNI funding and nano publications



- ▶ Cumulative NNI funding totals to 12 billion in 2001-2010.
- ▶ Annual growth rate of federal funding is 19.7%
- ▶ Annual growth rate of publications in USA is 21.9%.



Research questions



Who is funding
nanotechnology
R&D?

Who receives
funding and
produces research?

What is the
research output?



Method: funding acknowledgement analysis

- ▶ **Disclosure requirement**
 - ▶ Federal grants require researchers to acknowledge the source of federal funding
- ▶ **Linking research output to their funding source**
 - ▶ Sources of financial support in funding acknowledgement



Data collection

▶ Database

- ▶ Web of Science: Science Citation Index
- ▶ Funding acknowledgement is searchable since August 2008

▶ Search terms

- ▶ Topic: Nano*
- ▶ Affiliation: USA
- ▶ Publication Year: 2009
- ▶ Language: English
- ▶ Document type: Article

▶ Result

- ▶ 9808 publications
-



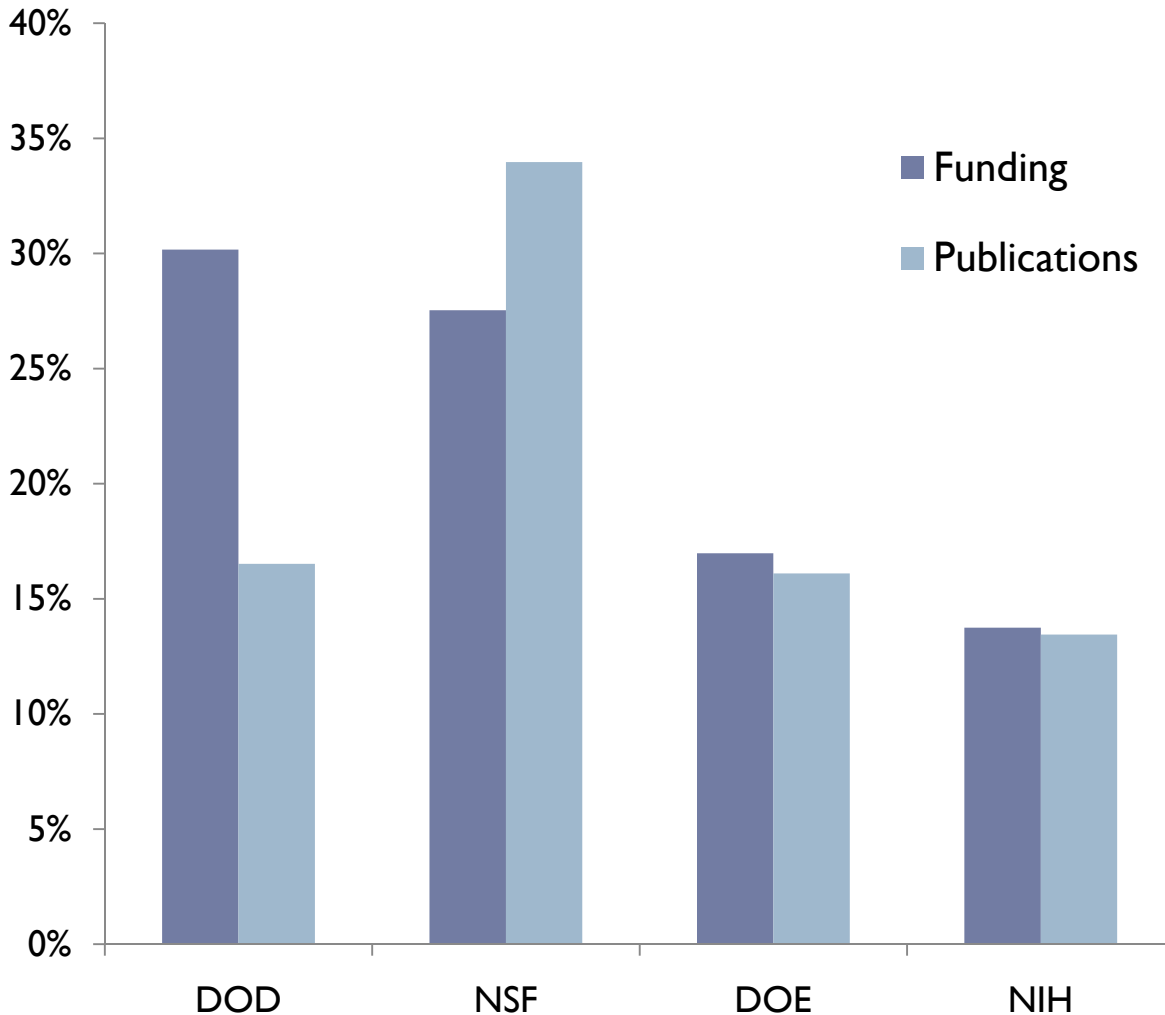
Top funding sources

	Funding Source	# Article	Share
1	U.S. National Science Foundation	3332	34%
2	U.S. Department of Defense	1620	17%
3	U.S. Department of Energy	1579	16%
4	U.S. National Institute of Health	1319	13%
5	China National Natural Science Foundation	360	4%
6	R.A. Welch Foundation	167	2%
7	China Ministry of Science and Technology	160	2%
8	U.S. NASA	146	1%
9	Deutsche Forschungsgemeinschaft (DFG)	113	1%
10	China Ministry of Education	100	1%

▶ 82% publications contain funding sources.

▶ 65% publications are funded by 10 agencies.

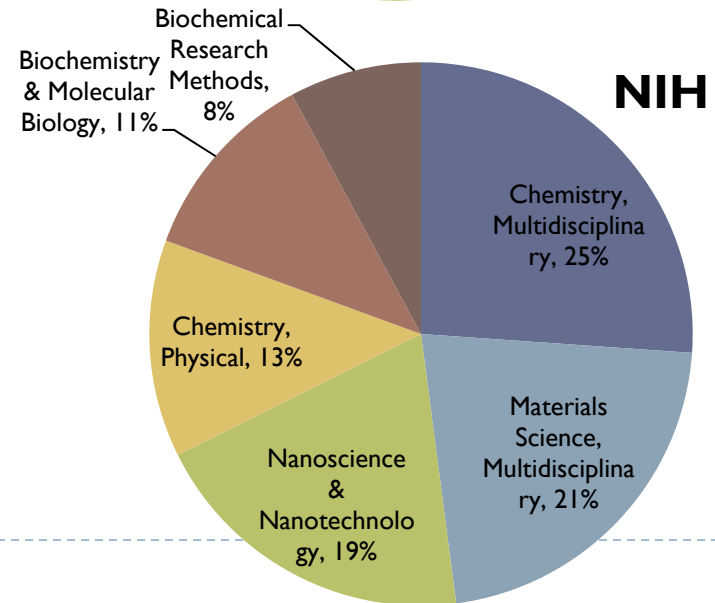
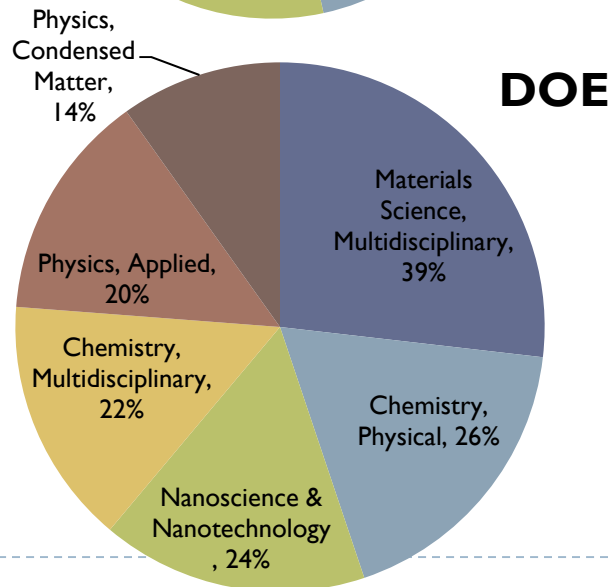
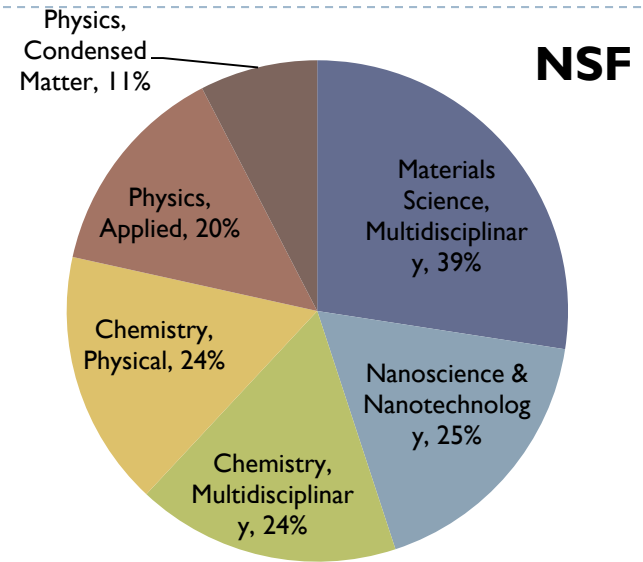
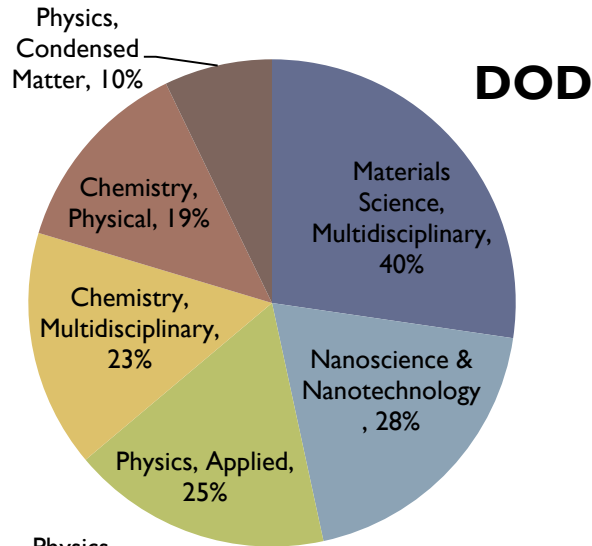
Major funding agencies



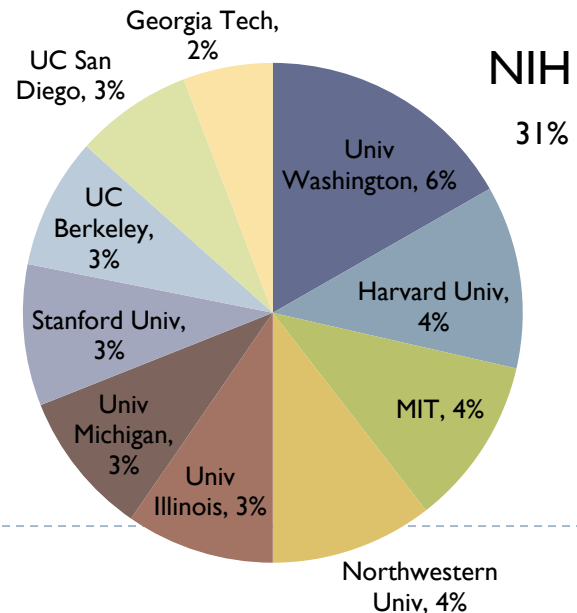
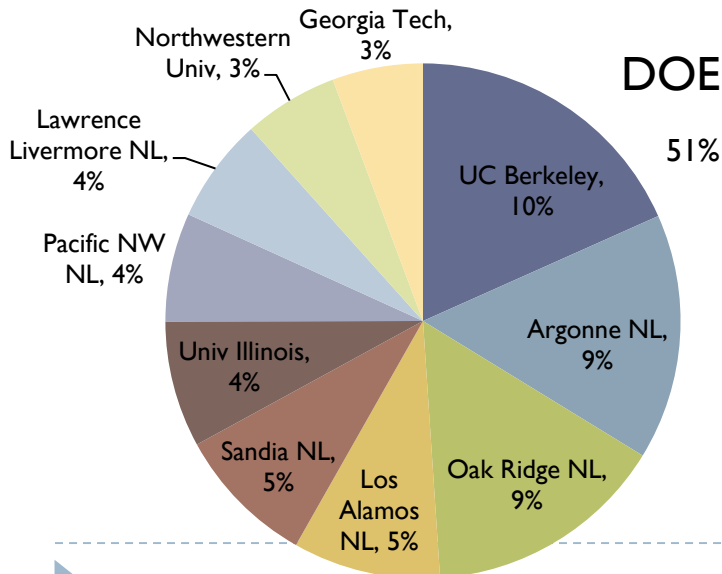
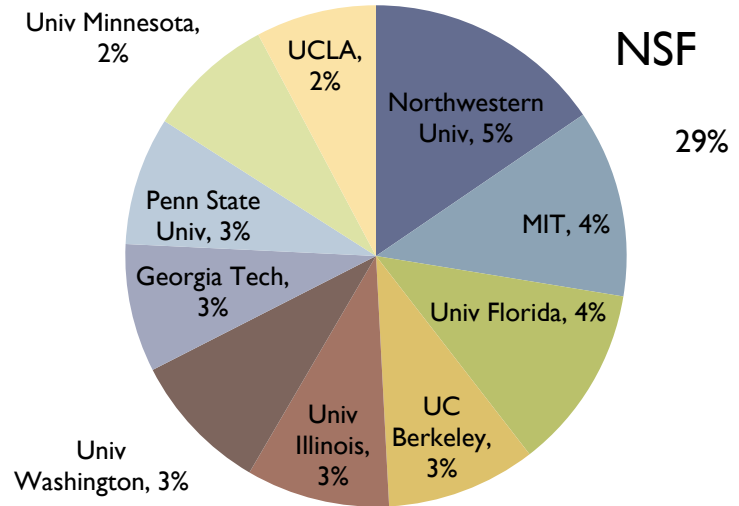
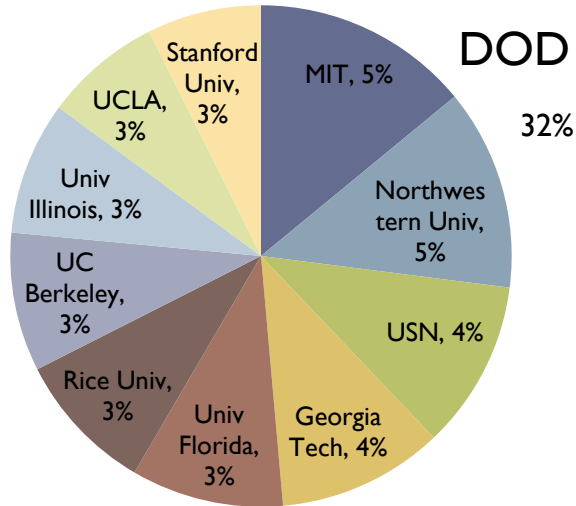
- ▶ 88% of federal funding in 2001-2008
- ▶ 61% of nano publications in 2009



Research field supported by each agency



Top institutions supported by each agency



Funding and publication

Nano funding from NSF (2006-2008)

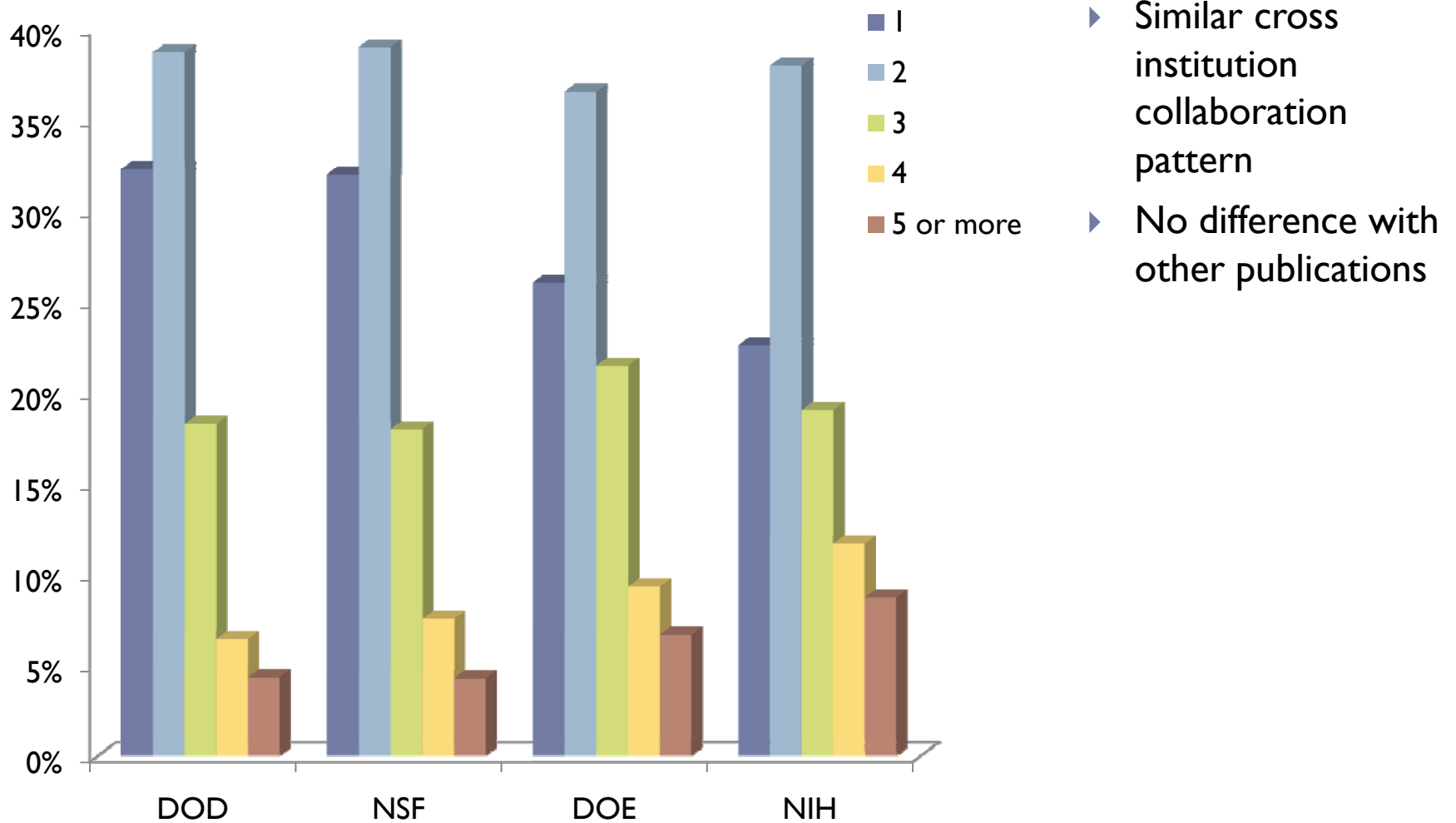
	Institutions	Awards (million \$)
1	UC Los Angeles	9.4
2	Duke University	8.0
3	Caltech	5.4
4	Georgia Tech	3.9
5	Northwestern University	3.1
6	Indiana University	2.9
7	UIUC	2.6
8	University of Connecticut	2.5
9	University of Washington	2.4
10	North Carolina State University	2.4

Nano publications in 2009 funded by NSF

	Institutions	Publications
1	Northwestern University	157
2	MIT	123
3	University of Florida	121
4	UC Berkeley	98
5	UIUC	94
6	University Washington	92
7	Georgia Tech	84
8	Penn State Univ	84
9	Univ Minnesota	83
10	UC Los Angeles	79



Number of author affiliations



Author country

Country	Share
USA	100%
China	5%
Germany	3%
South Korea	2%
Japan	2%
England	2%
France	2%
Canada	1%
Spain	1%
Italy	1%
Taiwan	1%
Russia	1%
India	1%
Australia	1%
Switzerland	1%
Israel	1%

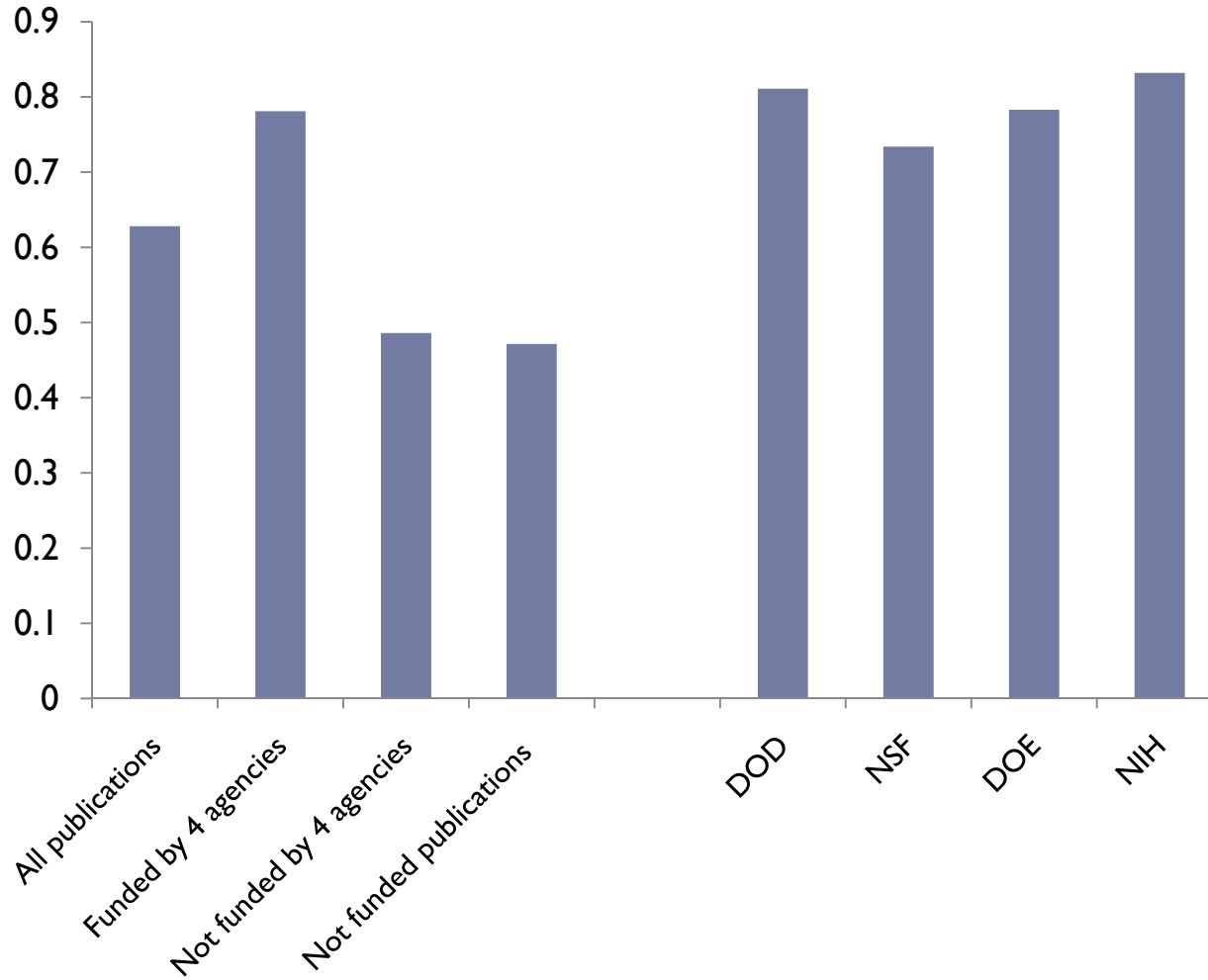
- ▶ Publications funded by 4 agencies
- ▶ Other countries benefit from federal funding

Co-funding sources

Country	Share
China National Natural Science Foundation	2%
R.A. Welch Foundation	2%
U.S. NASA	1%
Deutsche Forschungsgemeinschaft DFG	1%
China Ministry of Science and Technology	1%
European Commission	1%
Alfred P Sloan Foundation	1%
China Ministry of Education	1%
U.S. Environmental Protection Agency	1%
American Chemical Society	1%
Nature Science and Engineering Research Council of Canada	1%
Korean Government MOEHRD	1%
American Heart Association	1%
Petroleum Research Fund	1%
New York State Office of Science Technology and Academic Research	1%
U.S. Department of Commerce	1%

- ▶ Publications funded by 4 agencies
- ▶ Top countries
 - ▶ China
 - ▶ Germany
 - ▶ EC
 - ▶ Canada
 - ▶ South Korea

Citation



- ▶ Publications funded by agencies have higher citation rates.
- ▶ Small citation window



Discussion

- ▶ **Federal funding is making big contribution to nanotechnology.**
 - ▶ 2/3 supported by federal funding
 - ▶ 61% supported by NSF/DOD/DOE/NIH
- ▶ **Research field**
 - ▶ NSF/DOD/DOE: material, chemistry, physics
 - ▶ NIH: chemistry, biochemistry
- ▶ **Funding recipients**
 - ▶ NSF/DOD/NIH: universities; Top 10 institutions 30%
 - ▶ DOE: national labs; Top 10 institutions 50%



Discussion (cntd.)

- ▶ **Internationalization**

- ▶ Author country
- ▶ Foreign co-funder

- ▶ **Research impact**

- ▶ Comparable among agencies
- ▶ Significantly higher than other publications

- ▶ **Caveat**

- ▶ Not all funded research is published.

