



# NanoConnection to Society: ISSUES, APPROACHES, FINDINGS

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## ISSUES AND APPROACHES

ISSUES COVERED:

- Economics and Labor, Defined Broadly
- Ethics and Environment
- Public Responses

APPROACHES

- DATA BANKS
- NANOCONNECT AND NANOINDICATORS
- MONITORING PUBLIC AND OUTREACH



# NANOBANK

WHAT IS IT? **Data Bank of people, papers, patents, firms**

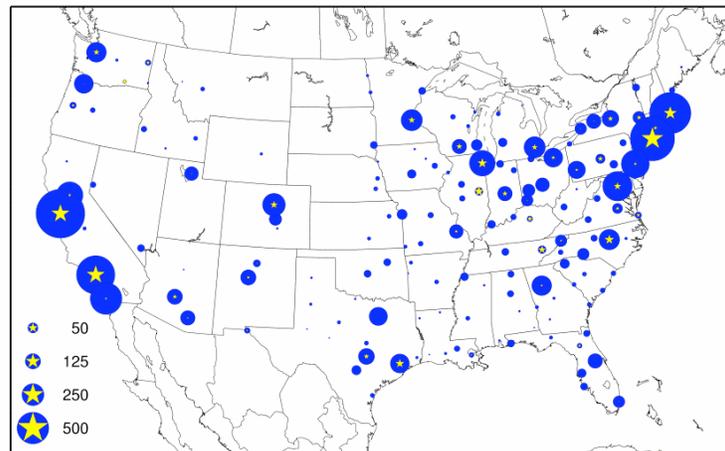
**KEY FINDING: Firm entry is more probable where & when the star scientists –top 250 individual researchers in terms of 20-year-rolling-window citation counts in ISIHighlyCited.com<sup>SM</sup>-- work in field.**

Based on Poisson Regression with control for local knowledge stock & economic geography: High-impact articles, University articles, University patenting, Total employment, Average wages (US). Study five other sci areas in addition to nano

**IMPORTANCE: Evidence of geographic effect indicates that people (through tacit knowledge) are more important than publications. Stars rather than disembodied discoveries.**

See Lynne G. Zucker, Michael R. Darby <http://www.nber.org/papers/w12172>

## Nanoscale Science and Technology Star Scientists & Firm Entry U.S. Areas, 1981-2004, and Summary Regression



Dependent Var: Firm Entry into Nano-technology

Significance at .001 : Star Scientists in Area; Employment, Wages

Significance at .01:

Significance at .05: High Impact Articles

No effect: University Patents, Articles

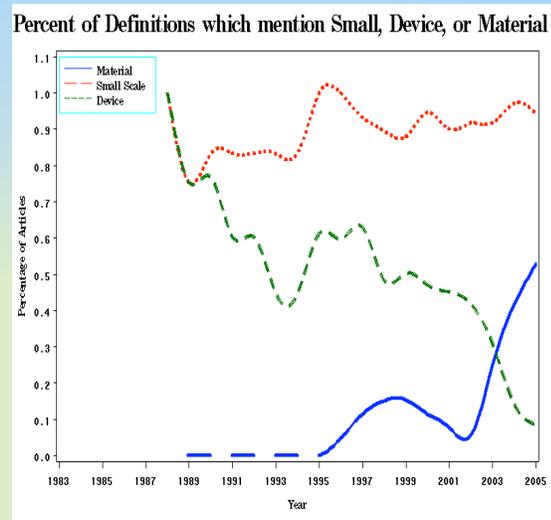
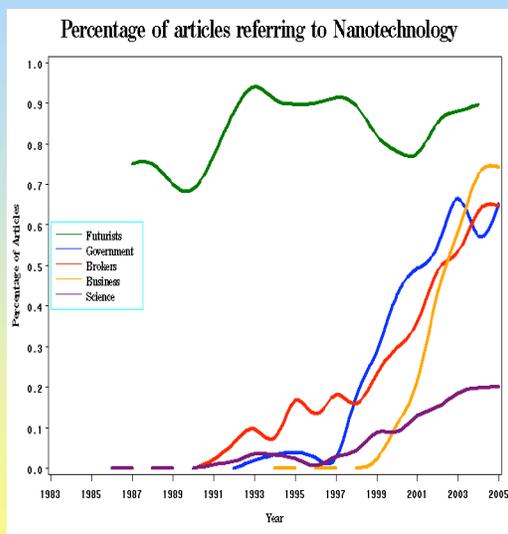
## NanoEthicsBank and More

**WHAT IS IT?** Data Bank of Statements by diverse groups concerned with nano-technology, including firms – currently 250 entries, with advanced searching capabilities to allow for categorizations: precautionary principle, trust, engagement, policies, FDA/EPA rule making; environment and health risks, etc. Current surveying potential users to get feedback on additional materials, categories, search

**MORE:** survey of 300 nano-tech firms on workplace health and safety issues (with Wilson Center and Wisconsin; addition of company based policies and standards)

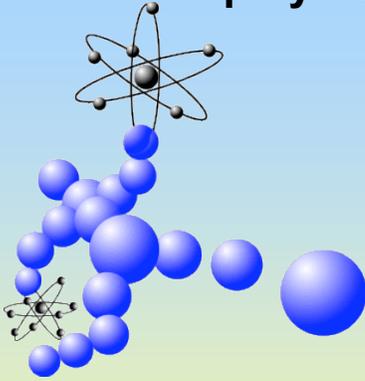
**KEY ISSUES AND USE:** Commonality and variation in normative ethics and description of actual practices will allow for analysis of the factors that impact practices; assist researchers, journalists, others; document trends

## Growth of Nanotechnology Label and by different communities and Changes in Connotation



Source: Stine Grodal, Stanford

## Employment and Careers DataBanks



JOB VACANCIES ON WEB: “spider” to search job boards for any job with Nanotechnology link: Working in Nanotechnology; Science Careers.org, tinytechjobs.com, Monster, etc

KEY ISSUES AND USE: Develop time series of job vacancies; randomly select number of jobs and find what happened to them; length of duration to fill; qualifications of the job candidate

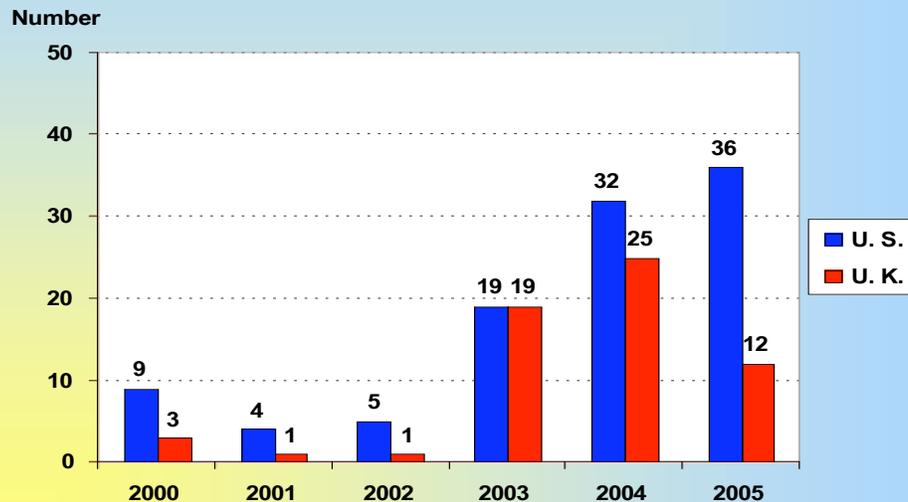
## SURVEY OF NEW ENVIRONMENTAL GRADUATES

Knowledge and possible use of nano-tech in their work. Working with Council of Environmental Deans and Directors.

- 1) Do you wish you had received more training in how technology developments in the following fields relate to the environment? Computer Sciences  
Nanotechnology Biotechnology Medicine/Health Energy
- 2) How much have you heard about nanotechnology? Heard a lot  
Heard some; Heard just a little; Nothing at all; Not sure
- 3) How do you feel about the benefits and risks associated with nanotechnology?  
Benefits will outweigh risks; Benefits and risks will be about equal; Risks will outweigh benefits; Not sure
- 4) How much do you know do you know about ways in which you could employ nanotechnology in environment-related fields? (scale 1-5)
- 5) How much do you feel you know about the applications of nanotechnology with respect to the environment? (scale 1-5)

## Public responses: Number of U.S. and U.K. nanotechnology risk articles

(additional data on numbers with health, environmental, regulation)



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### Principal Finding: Media studied are not alerting their readers to potential environmental and health risks from nanotechnology.

- Only 166 articles were found in six years of coverage in 29 U.S. newspapers and 2 wire services and 9 U.K. newspapers.
- The number of risk articles in the U.S. and U.K. rose in 2004, but they only increased by 4 articles in the U.S. and dropped by 13 in the U.K. in 2005.
- Because specialized nanotechnology publications and websites present more risk news, many people in the field are unaware of the paucity of newspaper and wire service risk information available to the public.

Source: Sharon Friedman and Brenda Egolf, "Reporting Risks of Nanotechnology in the Media" Nov 2, 2006

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**What: Dreaming of a Nanotech Christmas:  
What Persuades the Public to Embrace and  
Buy Nanotechnology?**

**Tuesday, December 5th, 2006, 2:00 – 3:00 p  
Woodrow Wilson International Center for S  
5th Floor Conference Room Ronald Reagan E  
and International Trade Center**

Currall,S., King,E.B., Lane,N., Madera,J.,& Turner,S. (2006). What Drives Public Acceptance of Nanotechnology? *Nature Nanotechnology* 1, 153-155.

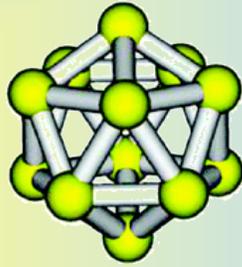
**Pilot Clearinghouse and Outreach in  
Nanotechnology: [WWW.Nanoconnections.net](http://WWW.Nanoconnections.net)**

Database consists of scholarly articles drawn from 11 selected journals in the fields of STS and risk analysis and communication. The database includes over 50 recent (2004-2006) articles focusing on nanotechnology and its impact on society. Articles are searchable, and can be arranged by approximately 20 different categories

Information on universities and colleges that have developed nanotechnology majors and minors, and courses, and is based on a web search and in many cases subsequent contact with the programs. This programmatic information is searchable by institution, state, course title, instructor, and year

# CONCLUSION: Coming Attraction

Fall, 2007 Conference on Occupational Health and Safety Issues in Nanotechnology Research and Manufacturing (with Santa Barbara) for wide audience of management, labor unions, and media



## APPENDIX

### 1) NANO HIGHLIGHT: Reporting the Risks of Nanotechnology in the Media

NSF NSEC #0531146-PI: Sharon M. Friedman with Brenda P. Egolf, Lehigh University

Numerous mass media articles have trumpeted many great things expected to come from nanotechnology. However, there is concern among government agencies and businesses interested in nanotechnology research that the public might reject nanotechnology products because of possible environmental and health risks. For example, a report by the Royal Society and Royal Academy of Engineering expressed concern about nanotechnology's current use in sunscreens and other cosmetic products and recommended this practice be stopped until further research is done (2004).

The Royal Society report, among others, also found that members of the public know very little about nanotechnology, including its potential risks. To track information available to the public about nanotechnology environmental and health risks as well as indicators of societal concerns, this baseline study content analyzed coverage in 2 U.S. wire services and 29 U.S. and 9 U.K. newspapers between 2000 and 2005.

For these six years, only 166 articles were found from a Lexis Academic database search about these nanotechnology risks -- 105 articles in U.S. and 61 in U.K. publications. Of these, 83% of the U.S. and 92 % of the U.K. articles appeared from 2003-2005. After rising in both 2003 and 2004, the number of articles dropped in 2005.

Early risks covered by the newspapers and wire services studied reflected debates over science-fiction-like issues such as "grey goo" and nanobots, particularly in the U.K. However, since 2003, attention has shifted toward covering more environmental and health risks. More than 85% of the 115 environmental risk and 113 of the health risk articles appeared between 2003 and 2005. Coverage also has become more topic specific, even though the majority of articles still mention some sort of general environmental or health risk from nanotechnology. Accumulation of nanoparticles that might contaminate soil, water, or landfills was the most prevalent specific environmental topic in U.S. articles and air contamination was the most prevalent topic in U.K. articles. In the health risk area, media coverage of nanoparticle damage to lungs and brains was prevalent, spurred by scientific studies. Articles discussing risks from use of cosmetics and sunscreens containing nanoparticles became more frequent recently, particularly in the U.K.

Between 2003 and 2005, an increasing number of articles, about one third of the total, discussed regulating nanotechnology risks. Calls for regulating these risks revolved around three issues: protecting the environment, people's health and safety.

#### References

- [1] For further information about this project contact Sharon Friedman, [smf6@lehigh.edu](mailto:smf6@lehigh.edu).
- [2] This highlight summarizes research reported in a presentation to the Society for the Social Studies of Science, Vancouver, CA, November 2, 2006.
- [3] Royal Society and Royal Academy of Engineering. (2004) *Nanoscience and Nanotechnologies: Opportunities and Uncertainties*. Viewed at [www.nanotec.org.uk/finalReport.htm](http://www.nanotec.org.uk/finalReport.htm), March 2005.

2) Pilot Clearinghouse and Outreach in Nanotechnology  
NSF NSEC Grant 0531146 PIs: Steve Cutcliffe with Christine Pense Lehigh University

The first stage of two pilot outreach databases, which are part of the CNS *Nanoconnection in Society Project*, are now available to be utilized via the [www.nanoconnections.net](http://www.nanoconnections.net) website. They allow researchers and the public better access to the issues in nanotechnology as they relate to society.

The first database consists of scholarly articles drawn from 11 selected journals in the fields of STS and risk analysis and communication. The database includes over 50 recent (2004-2006) articles focusing on nanotechnology and its impact on society. The articles are searchable, and can be arranged by approximately 20 different categories. An abstract of each article is included.

The second database includes information on universities and colleges that have developed nanotechnology majors and minors, and courses, and is based on a web search and in many cases subsequent contact with the programs. This programmatic information is searchable by institution, state, course title, instructor, and year. Where available, links to program descriptions and syllabi are provided.

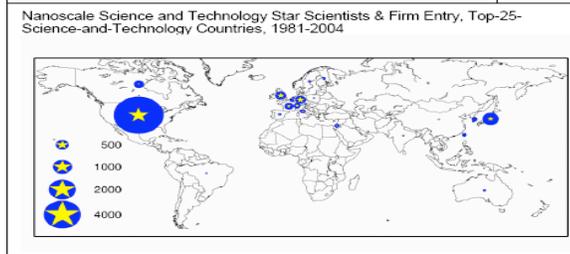
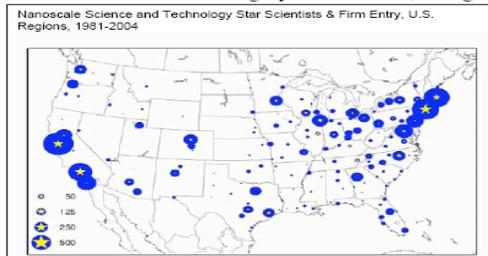
Subsequent work on these two projects will include continued updates on journal articles published each year and refinement of the details associated with the nanotechnology courses and programs. Additional programs and courses will be added as we become aware of them. Requests for inclusion in the latter data base are especially welcome.

References

[1] For further information about this project contact Christine Pense [cmp8@lehigh.edu](mailto:cmp8@lehigh.edu) or Stephen Cutcliffe [sc0@lehigh.edu](mailto:sc0@lehigh.edu).

3) Movement of Star Scientists and Engineers and Firm Entry in Nanotechnology NSF NIRT Grant 0304727  
NSF NSEC Grant 0531146 PIs: Lynne G. Zucker, Michael R. Darby UCLA & NBER

This paper extends the Zucker-Darby [2] concept of star scientist to all areas of science and technology, with special emphasis on nanotechnology. We follow careers 1981-2004 for 5,401 stars as identified in ISIHighlyCited.com<sup>SM</sup>, using their publication history to locate them each



year. The number of stars in a U.S. region or in one of the top-25 science and technology countries generally has a consistently significant and quantitatively large positive effect on the probability of firm entry in the same area of science and technology. Other measures of academic knowledge stocks have weaker and less consistent effects. Thus the stars themselves rather than their potentially disembodied discoveries play a key role in the formation or transformation of high-tech industries. The maps

show correspondence of stars and firm entry or adoption of nanotechnology. Total employment and average wages are also statistically significant in the US-regions but not in the 25-countries analysis. Stars become more concentrated over time, moving from areas with relatively few peers to those with many in their discipline. For the U.S. versus the other 24 countries, there is a counter-

tendency of foreign-born American stars to return to their homeland when it develops sufficient strength in their area of science and technology.

References

[1] For further information about this project link to <http://www.nber.org/papers/w12172> for Zucker and Darby, "Movement of Star Scientists and Engineers and High-Tech Firm Entry," National Bureau of Economic Research Working Paper No. 12172, April 2006, revised October 2006, or email [zucker@ucla.edu](mailto:zucker@ucla.edu) or [darby@ucla.edu](mailto:darby@ucla.edu).  
[2] Zucker, Darby, and M.B. Brewer, "Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises," *American Economic Review*, March 1998, 88(1): 290-306.