

CNS-UCSB

Center for Nanotechnology in Society



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1 January – 31 December 2007

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NSEC: CENTER FOR NANOTECHNOLOGY IN SOCIETY UNIVERSITY OF CALIFORNIA AT SANTA BARBARA

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Innovation and Globalization

Risk Perception and Social Response

Education and Outreach

Nanotechnology in Society Network

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University of South Carolina

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CNS-UCSB 2007

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**NSEC: CNS-UCSB Annual Report
Year 2: January – December, 2007**

I. Introduction to the CNS-UCSB

The NSF Center for Nanotechnology in Society at UCSB serves as a national research and education center, a network hub among researchers and educators concerned with societal issues concerning nanotechnologies, and a resource base for studying these issues in the US and abroad. The Center addresses education for a new generation of social science and nanoscience professionals, and it conducts research on the historical context of the nano-enterprise, on innovation processes and global diffusion of nanotech, and on risk perception and social response to nanotechnologies. It also develops methods for public participation in dialogue about nanotechnologies' futures. The Center's three interdisciplinary working groups combine expertise in many fields: technology, culture, politics, health, spatial analysis, and science and engineering. They address a linked set of social and ethical issues regarding the domestic US and global creation, development, commercialization, production, consumption, and control of specific kinds of nanoscale technologies. The work of the CNS-UCSB is intended to include diverse communities in the analysis of nanotechnology in society and to engage in outreach and education programs that include students and teachers and that extend to industry, community and environmental organizations, policymakers, and the different sectors of the public.

The Center draws on UCSB's renowned interdisciplinary climate to integrate the work of nanoscale engineers and physical and life scientists with social scientists studying nanotechnology in society. Close ties with the internationally prominent nanoscale researchers connected with the California NanoSystems Institute and with social science research centers at UCSB focused on relations among technology, culture, and society are enhanced by social science collaborators at UC Santa Cruz, UC Berkeley, the Chemical Heritage Foundation, and Duke University in the US, and Cardiff University, UK, University of British Columbia, Canada, University of Edinburgh, UK, and CNANE in China.

The CNS-UCSB began its operations in January 2006 and spent the first year laying the foundation for its programs and initiating research, education, and outreach activities. In Year 2, these operations have been fully implemented, and results in all phases of Center activity have begun to be realized. CNS-UCSB acknowledges the support from NSF under SES-0531184 and requests the third increment of funding for the project for the period 1 January 2008 through 31 December 2008.

II. Research Activities

The Center's research program is designed as a systems-level analysis of nanoscale research and development, the global diffusion of nanotechnologies, and responses to nanotechnologies as they emerge. Research is organized within three Working Groups: Working Group 1 -- Historical Context of Nanotechnologies, seeks to develop a rich understanding of the past and current landscape of the nano-enterprise; Working Group 2 -- Innovation, Diffusion, and Globalization

of Nanotechnology, will develop a comprehensive understanding of the processes of innovation, global diffusion, and commercialization of nanotechnology; and Working Group 3--Risk Perception and Social Response to Nanotechnologies--focuses on publics' and experts' perceptions and social intelligence about nanotechnologies, social amplification and attenuation of risk, methods for deliberation, and collective action in response to emerging nanotechnologies. Important features of our collective approach are an integrated, participatory relationship with nanoscientists; a focus on specific nanotechnologies such as nanoelectronics, nanoparticles such as quantum dots, and nanoporous materials; comprehensive consideration of their applications in industries like electronics, energy, environmental, and health; and employment of advanced spatial analytic methods and a global framework for analysis.

As of July, 2007, which is our eighteen-month mark, all 3 Working Groups are in active research, and we are beginning to generate research findings and disseminate to a number of different kinds of audiences in publications and reports. We anticipate a significant increase in notable findings and publications by the end of Year 2 (Dec 2007). Following is a summary of the activities of each Working Group and our research integration efforts. Because our last annual report was submitted half-way into year 1 and could only project activities for the 2nd half of the year, we are also including activities from July to December 2006.

**CNS-UCSB Research Activities 2007
Year Two Report for Working Group 1
Historical Context of the Nano-Enterprise
July 2006-December 2007
W. Patrick McCray, Leader**

Our working group is composed primarily in Year Two of W. Patrick McCray, Cyrus Mody, and Mary Ingram-Waters; for part of Year Two, Timothy Lenoir and Eric Giannella (both of Duke University) directly participated in our group's research as well. The goal of WG1 is to produce and integrate a diverse range of historical sources and research tools in order to understand specific facets of the nano-enterprise's history.

Understanding nanotech's societal implications is predicated on possessing a clear and comprehensive understanding of its historical context. This requires examining nanotech's history at multiple levels of analysis – scientists' careers, research communities, instrumentation, national and state policy, and the role of public imagination and interest in “visionary engineering ideas.”

For the historian, the study of nanotech presents a series of challenges and opportunities. The opportunities derive from the chance to work collaboratively with other disciplines and to study the emergence of a large-scale technological enterprise. The challenges relate, in part, to the nature and preservation of the historical record and in part to the vastness of the subject itself. The ephemeral nature of the documents and sources available is especially problematic. This, in effect, makes the “first draft” of history we are doing even more urgent.

Below are descriptions of the research areas our group explored during the second year of CNS activity. This covers the time period from July 2006 to June 2007 with projected activity to the end of December 2007

WG 1, Area 1: “Over the Horizon” Technologies and the Case of Nanoelectronics; From Nanocrystals to Quantum Dots

Led by: W. Patrick McCray

Team members: Timothy Lenoir (Duke University), Eric Gianella (Duke University)

Activities to Date:

We continued to process interviews related to spintronics already conducted by McCray as well as assemble and collect primary source materials related to nanoelectronics. In addition, McCray began writing a draft of a paper he will present in June 2007 at the CHF-Wharton School nano conference. This research charts the growth of activities in spintronics at academic, commercial, and government laboratories. We were especially interested in evaluating the place of nanoelectronics and spintronics on the technology roadmaps of the semiconductor industry as well as how funding from DARPA and industry has fostered the growth of this field. The overall importance of nanoelectronics in the establishment of the National Nanotechnology Initiative will also be considered. Oral histories and documentary evidence combined with data produced by Lenoir’s group (see below) has provided the evidentiary base of this research.

During Year 2, McCray, with feedback from David Awschalom and Stuart Wolf, continued to revise this spintronics narrative. In June 2007, he presented the results of this work at two different meetings. One was the joint Wharton School-CHF meeting in Philadelphia; the other was to an audience of scientists at the Spintech IV meeting in Maui.

In late June, McCray will submit a version of this paper for publication in the journal *History & Technology* or *Technology and Culture*. The final part of this project will be to complete the oral history interviews started (Awschalom, Gossard, Flatte, and Loss). He will likely complete these in Summer 2007.

Following acceptance of the spintronics paper, McCray will conclude research on spintronics and shift to a historical study of nanocrystals and quantum dots. This new direction, while essential in its own right, will also help link the study of MBE and nano-structured materials for electronics applications. This research, which will begin once the spintronics project is complete, will explore the science and technology behind the development of both MBE-grown and chemically synthesized nanocrystals (aka quantum dots). This research, ideally, will take advantage of data gathering and mapping techniques similar to those Lenoir and his students developed for the case of spintronics.

WG 1, Area 2: Mapping the Nano-Enterprise

Led by: Tim Lenoir

Team Members: Eric Giannella and W. Patrick McCray

Activities to Date: In Year Two, we continued developing methods for depicting the structure of nanotech generally, its relation to other research areas, and generating helpful and meaningful visualizations of the historical dynamics of subfields of nanotech in relation to other fields. We also developed generalized approaches to visualizing the results these clusters and the

development of fields over time. This problem is particularly thorny, because while it is relatively straightforward to use citation and patent data to cluster documents, it is difficult to represent the structure of the research areas clustered in intuitively useful visual representations.

The general approach we have pursued is to develop methods for tracking the emergence and development of what practitioners refer to as “technology platforms.” A technology platform is a foundational core technology which is a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced. One direction of our research has been to develop methods for mapping and visualizing the formation of technology platforms and the research groups involved in developing them in several areas. We are working on a publication that lays out our methodology and applies it to several fields.

In addition to working on these general methodologies in support of CNS projects, Eric Giannella has concentrated on applying these tools to support McCray’s and the efforts of Working Group 1 on spintronics. Giannella has now completed that work and passed it off to McCray for use in his publications and presentations on spintronics. During Year Two, Giannella had three major objectives which are described below:

Tracking Growth of Spintronics: Eric Giannella at Duke University collaborated with two graduate students in the Physics Department at UC Santa Barbara to develop a comprehensive query that identifies spintronics related literature. The query was developed through an iterative process that took into account the usefulness of each keyword and keyword combination in identifying pertinent material and avoiding the introduction of material not relevant to spintronics, or “noise.” After reviewing the keyword lists and testing each term, a query was settled upon that returned 9,099 articles in the Scopus database.

Each article was downloaded from Scopus to perform local analysis of trends in publications and participation among nations, institutions, and authors. By assigning each article a unique identifier, all its pertinent bibliographic fields could be split into entities such as individual authors, or separate organizational affiliations while maintaining the original association with the article.

Using this method of splitting fields into individual entities, we tabulated the number of times particular organizations appeared on spintronics articles. Care was taken to account for common typos and name variations in organizational names, such as “University of California Santa Barbara” and “UC Santa Barbara.” Eventually, the top publishing organizations in spintronics related research were identified and included a mix of North American, European, and Asian institutions and represented academic and corporate labs.

A similar procedure was used for identifying top authors in Spintronics. Often, the author’s last name was used to search the database in case of variations in first and middle name inclusion, spelling, and abbreviation. Country data was more straightforward as the country names were already fairly standardized in the data retrieved from Scopus.

In order to identify the top cited Spintronics articles, all articles in the database (9099) were plotted according to their year (x axis) and the number of citations received (y axis). In order to account for the higher probability that an article is cited the longer it has been in existence we studied citation trends in the dataset. We traced a rough curve that followed the average of the most cited articles per year and articles that fell above the curve were selected as the top cited articles.

Mapping Migration and Collaboration Patterns: The goal of this project was to see what the collaboration patterns among spintronics researchers would look like as the field matured from 1988 to the present. In particular, attention was paid to international collaborations and collaborations between individuals of different organizational types, such as corporate-academic partnerships. For this part of the study, a coauthorship was treated as a collaboration, and articles with more than thirty coauthors were excluded because it was likely that most of these authors never formally collaborated on the underlying work.

We identified 105 researchers using IBM and UCSB Spintronics conference attendee lists. To gather these scientists' articles, we used the Harvard-Smithsonian astrophysics and physics database which dedicated to physics research, and allows for full name searching. This makes it preferable to services such as Web of Science, which rely only on last name and first initial and cover all scientific disciplines resulting in matches between different authors.

After searching for a particular scientist's work, we reviewed article titles to ensure that they were plausibly by the same author (similar topics or gradual changes in topics). When in doubt, we checked the researcher's personal homepage, looked at his research interests and list of publications, if available. We downloaded and merged bibliographic data for each author's articles in order to import the complete set (105 individuals' cumulative work) into a database.

For each individual we tracked, we created a career history, identifying his or her organizational affiliation on a year by year basis since 1988 using CVs (from web pages) and article data. Each organization was also associated with an address, which we used to identify GIS coordinates for placing the author on the map for that particular year. Each organization was also associated with an organization type, which determined the icon that represented an author in a given year.

Using unique identifiers for articles, we established coauthorship relationships in our database among the 105 spintronics researchers we were tracking. These coauthor relationships were stored and coded with the year of the collaboration and coordinates of the two authors at the time.

We wrote software to read the location information and identify when an author moved, indicating a move with a green line from the previous year's location to an icon that indicated the author's new location. The software also formatted all the article link, GIS, organization, icon, color, and collaboration data to be imported to Google Earth. The resulting file can be opened in Google Earth, it represents collaborations as a blue line spanning coauthors' locations, organizational types on a yearly basis by certain icons, movement on a yearly basis with green lines and green icons (indicating the new location), scientist names are shown next to the scientist's location in that year. Clicking on an icon displays a scientist's location, affiliation, and

articles published in that year, which are hyperlinked to Google Scholar. The interactive Google Earth file can be downloaded from:

<http://www.duke.edu/~reg11/spin.kml>

Mapping DARPA Spintronics Conference Attendees: We keyed data for roughly 500 attendees from a total of three DARPA conferences (2000, 2002, 2004) on spintronics. We entered the attendee's name, location, and organizational affiliation into a database. Our group developed software that read attendee locations and assigned appropriate GIS coordinates. Each organization was associated with an organizational type (corporation, academic institution, government lab) and these types were used to determine an icon representing attendees for each conference year. The resulting data was parsed with a tool similar to the one used to map Spintronics researcher movement and collaboration and the file was read into Google Maps for a flat projection of the 2000, 2002, and 2004 conference attendee locations.

Gianella sent a final version of the data and results in mid-December 2006. This effectively concludes this particular mapping exercise which focused on spintronics. The data collected was detailed enough to provide a clear first order sense of publication, patenting, and research trends from 1988 to 2006. This provides a much firmer evidentiary base for subsequent publications and presentations on spintronics. In 2007, we expect Lenoir's group – pending adequate funding – to begin mapping the NNIN facilities and their users. Finally, Lenoir's group is preparing a publication that details their overall methodology.

Since January 2007, Lenoir has been collaborating with other WG members and future progress reports from him will presumably detail a wider range of activity. Future progress reports from Lenoir will not be included in WG1 reports but will be solicited directly by CNS. See Lenoir report below (following WG2 report).

WG 1, Area 3: Nanotechnology Oral History Project

Led by: Cyrus Mody (Chemical Heritage Foundation)

Activities to Date:

Mody spent much of Year Two writing and presenting papers on the history of nanotechnology, most of which draw on material from the oral histories conducted last year. Published versions (if any) of all these papers will carry an acknowledgement of NSF support. Please note that two of these talks were given at science/engineering conferences rather than history meetings. This is a good sign that nano and society community is interested in what WG1 has to offer, and that the CNS-UCSB "brand" is reaching a wider audience. One of the papers, presented to the Spanish National Research Council, contains some meta-level discussion on the place of history in social studies of nanotechnology. It is possible this paper would help situate WG1 in the larger universe of NSF-funded nano-ELSI research.

A second paper, by Mody and Hyungsub Choi, is forthcoming from *Social Studies of Science*. This paper, "Molecular Electronics in the *Longue Durée*: The Microelectronics Origins of Nanotechnology" relies on interviews conducted as part of WG1's activities (esp. Ratner and Williams). Its themes are almost wholly complementary to those of McCray's work on spintronics; this shows that WG1's different activities are gaining synergy and creating a coherent but wide-ranging picture of the development of nanotechnology.

Meanwhile, work continued at CHF under Mody's direction on the oral histories conducted last year. Stan Williams' and Alan Heeger's transcripts are ready to be bound and published, with copies going to the interviewees and to CNS-UCSB. Paul Hansma has returned his transcript; as soon as his changes are entered it also will be bound and published. Alan MacDiarmid's transcript is complete pending final approval from his widow. Only two transcripts are still with the interviewees – Mark Ratner and Jane Alexander. Over the summer Mody will continue to press these two for their edits.

Upcoming activities are in flux due to Mody's acceptance of a position at Rice. Since he will no longer be at CHF (and CHF will be deemphasizing nanotechnology), the oral history program will need to be revised after Year Two. However, Mody has completed interviews with Bob Buhrman (of Cornell – related to spintronics and microfabrication themes of WG1) and Jim Murday (formerly of ONR/NRL – related to policy/grant officer theme of WG1). Those interviews will be processed by Mody's research assistant, probably in late 2008. Mody also did a background interview with Joe Bordogna, NSF administrator under Clinton and an influential figure in the founding of the NNI; this interview will provide material for the rest of WG1.

While at Rice, Mody will begin a new project analyzing how local leaders built campus nano institutions in the '90s, taking Rice and Cornell as case studies. Burhman's OHI and other interviews will make up the Cornell half of this project; at Rice, Mody will have access to numerous scientists (such as James Kinsey) and archives that will enable that half of the research. He has been promised a steady supply of research assistant to help in processing oral histories. He and McCray will also maintain contact with the Chemical Heritage Foundation. CHF's microelectronics program area, under Hyungsub Choi, will likely do 1 or 2 oral histories per year that overlap microelectronics and nanotechnology (e.g. Sumio Iijima at NEC, discoverer of the carbon nanotube). CHF could also be tasked with binding and publication of oral histories performed under WG1's auspices. Finally, given CHF's decision to deemphasize nanotechnology, McCray has begun negotiations with Babak Asrafi of the new formed Philadelphia Area Center for History of Science with the intent to perhaps leverage their interest and funding with that of the CNS.

WG 1, Area 4: Nanotechnology, Futurism, and Public Imagination

Led by: Mary C. Ingram and W. Patrick McCray with research assistance from William Bausman

Activities to Date:

In Year Two, this group refined its research focus to look at the way that scientifically-oriented social movements, specifically those led by prominent nanotechnology advocates, have affected public perceptions of nanotechnology. For most people, the concept of a social movement likely invokes archetypal images of protesters, police with pellet guns and mace, hunger strikes, and the like. However, researchers who study social movements have illuminated a much wider range of collective behavior activities. At their most basic level, social movements can be defined as having the following features: participants advocate change; participants have intentions for change; participants are organized into collective social groups; and participants use extra-institutional channels for advocacy. Thus, protests are hardly the only defining feature of a social movement. Whether or not the advocacy groups that promoted particular

conceptualizations of nanotechnology in the early 1980s constitute a social movement *is a researchable question*.

Our hypothesis is that these groups and prominently placed individuals did form a coalition with the specific intent of promoting nanotechnology. Not only does this research group intend to test this hypothesis, but we also intend to understand from where the nano-advocates originated. Surely it is a relevant issue to explore: many of the primary nano advocates of the early 1980s were also committed advocates of the pro-space movement.

At this point, we have collected and organized a vast amount of organizational texts from two social movement groups, the L5 Society and the Foresight Nanotech Institute, representing pro-space and pro-nano, respectively. Will Bausman, an undergraduate Philosophy and Physics double-major, greatly assisted us with the data collection and coding processes. We also identified more than a dozen prominent members in both organizations to be interviewed. As of May 2007, Ingram-Waters and McCray have interviewed five individuals. All of the targeted respondents have been contacted and most have agreed to be interviewed during the summer months of 2007. By fall of 2007, Ingram-Waters will have processed all of the interviews. We plan to write and submit an article tracing the social movement spillover between the pro-space and pro-nano advocacy groups, based on these interview data and primary source documents, by late Fall 2007. We have already drafted a working paper based on the data that we have analyzed thus far. A poster of this preliminary analysis will be presented by Ingram-Waters at the Wharton-Chemical Heritage Foundation Joint Symposium on the Social Studies of Nanotechnology in June 2007, Philadelphia, Pennsylvania. A further refined analysis will be presented at the Annual Meeting for the Society for the Social Studies of Science in Montreal.

WG 1, Area 5: Exploring “Hidden Histories” of Nanotechnology

Led by: W. Patrick McCray

Team members: William Bausman (through May 2007)

Activities to Date:

An important historical question concerns the creation and validation of nanotechnology’s creation story – the “standard model” begins with Richard Feynman’s 1959 speech, moves to the apostolic role of K. Eric Drexler, to the instrumental capabilities demonstrated by Binnig and Rohrer and their development of the scanning tunneling microscope, and culminates with the passage of the NNI. There is a continued need to move away from the limitations of this basic story toward a more complex and nuanced understanding of nanotechnology’s past and current context. Surely there are other “hidden” histories of nanotechnology. What are they and why have they not been visible?

In Year Two, McCray collaborated with members from the UCSB Materials Science Research Center to develop a proposal for a planned NSF-funded Chemical Design of Materials Center. In October 2006, McCray participated in the NSF site visit for the proposed Chemical Design of Materials center. His contribution to this effort was to discuss areas of additional collaboration between scientists and CNS researchers. The specific contribution McCray envisioned was to be a historically-based web exhibit and accompanying book called *From Craft to Nanoscience*. This would have addressed the history of materials design and manufacturing, focusing on the improved ability of people since the early modern era to see, model, and manipulate materials.

Harvard University Press has already expressed interest in the book project and McCray planned to explore it further following completion of his current (unrelated) book project. Funding from the CDM would have enabled McCray to do the research for the book project. During the Fall of 2006, McCray put a considerable amount of time into helping the UCSB team prepare for the NSF site visit. However, the proposed Chemical Design of Materials center was not funded and, therefore, plans for the proposed *From Craft to Nanoscience* book are on hold until additional funding materializes.

In March 2007, McCray finished an article for *Nature Nanotechnology* on the history of molecular beam epitaxy. This was published in May 2007 and it addressed the evolution of MBE as a critical and early nanofabrication technique. Molecular beam epitaxy is widely used in research and industry to fabricate semiconductor devices and structures. However, despite its ability to control matter with near-atomic precision, the technique is overlooked in most histories of nanoscience and nanotechnology.

Feedback from both the National Advisory Board and the NSF site review on the “hidden history of nano” was very positive. WG1 was encouraged to consider other aspects of these so-called hidden histories. At the moment, McCray is considering a book-length treatment of pro-technology advocates in the 1970s and 1980s in response to the controversial “limits to growth” thesis. This would explore, for example, links between individuals and institutions advocating frontier technologies like private space exploration, nanotechnology, and cryonics during the Carter and Reagan years. It would necessarily build upon the collaborative work he is doing with Ingram-Waters in Area 4.

In terms of discrete hidden histories, one topic is that of the nano-enabled space elevator (SE). Central to the plot of Arthur C. Clarke’s 1978 book “The Fountains of Paradise” is the concept of a space elevator. His book appeared at a time of renewed international interest in space exploration and space colonization. Within a few years, however, pro-space advocates like K. Eric Drexler turned their attention to promoting nanotechnologies and molecular manufacturing. While Clarke’s vision was, of course, never realized, his idea of a space elevator gained renewed life following the widespread scientific attention paid to novel carbon nanostructures in the 1980s and 1990s. While still in a liminal state that blends fantasy and actual engineering studies, proposals for a space elevator resemble the visionary engineering analyses that marked the early Space Age. This research explores the reconvergence of space exploration and nanotechnology as witnessed by the interest in space elevator technologies and the engineers advocating them. McCray will do research on this in Summer 2007 and present a paper on these findings in October 2007 at the annual Society for History of Technology meeting. The research will consist of interviews with primary persons involved with the SE and an analysis of how nanotechnology in the form of carbon nanotubes has served as a means of generating credibility. This research will focus on the SE as yet another example of the space-nano connection.

Finally, as a way of shedding another light on the hidden history of nano, McCray plans to write another essay for *Nature Nanotechnology* about the value of historical analogy and how a comparison between the space sciences of the 1960s and current nanoscience research could offer some valuable insights. He expects to do this sometime in early 2008, contingent on progress in other research areas.

Products from Working Group One Research for Years One and Two

In 2006-2007, we published or have prepared in draft form for submission several publications based on CNS-supported research. These included (listed alphabetically):

- Mary Ingram-Waters. "Spaceflight, Frostbite, and Foresight: Exploring the Connections between Pro-Technology Advocacy Groups, 1974-1990." (with P. McCray). Working paper in progress for publication in 2008.
- Tim Lenoir and Eric Giannella, "The Layers of Patent Data and the Use of Patents in Tracking Technological Platforms," Working paper in progress for publication. Duke University
- W. Patrick McCray, "MBE Deserves a Place in the History Books," *Nature Nanotechnology*, 2007, 2, 5: 2-4.
- W. Patrick McCray, "Over the Red Brick Wall: Spintronics, Novelty, and Over-the-Horizon Technologies," paper submitted to *History and Technology* and *Technology and Culture* for review.
- Cyrus Mody (with Hyungsub Choi). "Molecular Electronics in the *Longue Durée*: The Microelectronics Origins of Nanotechnology." Article accepted for publication in *Social Studies of Science* and to appear 2008.
- Cyrus Mody, "Some Thoughts on Why History Matters in Understanding the Social Issues of Nanotechnology and Other Converging Technologies." Article submitted in 2007 to *Nanoethics*.
- Cyrus Mody, "Building a Probe Microscopy Community." Article submitted in 2007 to *Journal of Chemical Education*.

Members of our group also gave numerous presentations in 2006-2007. Several of these were internal to CNS as part of the seminar series for grad fellows. Those presented at external events and meetings included (listed alphabetically):

- Ingram-Waters. "Spaceflight, Frostbite, and Foresight: Exploring the Connections between the Pro-Space, Cryonics, and Nanotechnology Social Movements," poster presented at Chemical Heritage Foundation- Wharton Joint Symposium on Nanotechnology, Philadelphia, PA, June 2007.
- Ingram-Waters. "From Spaceflight to Foresight: Tracing The Social Movement Spillover Between Space and Nano." paper to be presented at annual meeting of the Society for the Social Studies of Science, Montreal, October, 2007.
- McCray, presentation of WG1 research at March 2007 PIs meeting at the NSF.
- McCray "Spintronics, Novelty, and Over-the-Horizon Technologies," paper presented at the Spintech IV conference, Maui, June 2007.
- McCray "Over the Red Brick Wall: Spintronics as an Over-the-Horizon Technology," presented at Wharton-Chemical Heritage Foundation Symposium on Social Studies of Nanotechnology, Philadelphia, June 2007.
- McCray "Reconverging Technologies: Space, Nano, and Fountains of Paradise," (with Mary Ingram-Waters), paper to be presented at annual meeting of the Society for History of Technology, Washington, DC, 2007.

- Mody. “Conferences, Community, and Nanotechnology: From Birth to Rebirth,” (Vancouver: Society for Social Studies of Science annual meeting, November 4, 2006).
- Mody. “Molecular Electronics in the *Longue Durée*,” (Philadelphia: University of Pennsylvania Department of History and Sociology of Science, November 13, 2006).
- Mody. “The Long Arm of Moore’s Law,” (Amherst, Mass.: Amherst College Law and Science Seminar, November 27, 2006).
- Mody, “Molecular Electronics and the Microelectronics Origins of Nanotechnology,” (Tempe, Ariz.: Nano and Giga Challenges in Electronics and Photonics Symposium, March 16, 2007).
- Mody, “Building a Probe Microscopy Community,” (Chicago: Pittsburgh Conference, 18th Annual James Waters Symposium Recognizing Pioneers in the Development of Analytical Instrumentation).
- Mody, “Molecular Electronics in the *Longue Durée*: Microelectronics, Futurism, and Nanotechnology,” (Houston: Rice University Department of History, February 12, 2007).
- Mody, “Some Thoughts on Why History Matters in Understanding the Social Issues of Nanotechnology and Other Converging Technologies,” (Madrid: “Making the CTEKS” workshop, Spanish National Research Council, February 6, 2007).

Year Two Report for Working Group 2
Innovation, Diffusion, and Global Development
Globalization Group
Richard Appelbaum and Gary Gereffi, Co-Leaders
July 2006 - December 2007

Research Projects: July 1, 2006 through June 30, 2007

- **Field Research in China:** Fieldwork team led by Appelbaum and Gereffi (Duke subcontract), with CNS Fellows Rachael Parker and Yiping Cao, and Gereffi’s RA Ryan Ong. Interviews conducted in Hong Kong and China (Beijing, Shanghai, Tianjin). Principle research July 26-August 9, 2006; additional interviews by Cao during following week at Dalian (University) Institute of Chemical Physics and meetings in Shanghai of International Center on Design for Nanotechnology. 30+ interviews with scientists, engineers, and policy-makers, including at Hong Kong Polytechnic University, Shanghai JiaoTong University, Fudan University, Dalian Institute of Chemical Physics, Peking University, Nanotechnology Industrialization Base of China (Tianjin), Shanghai Nanotechnology Promotion Center, Chinese Academy of Science Institutes, and International Mesosstructured Materials Association meetings, and American Chamber of Commerce (AmCham) in Shanghai.
- **China Nanotechnology Co-authorship – Data-Mining and Analysis:** Eric Giannella (RA for Tim Lenoir, Duke subcontract) and CNS Fellow Rachel Parker have assembled a dataset of Chinese nanoscience and engineering publications in leading English-language journals through 2005. These included 81 journals with an impact factor above .8, which contained roughly 14,000 nanotechnology articles by at least one China-based author. Thus far they have analyzed the total number of publications without regard to impact. Analysis in progress includes (1) the determinants of high-impact publications, focusing on the role of international collaborations, distinguishing between collaborations involving non-Chinese

and Chinese colleagues working outside of China; and (2) an analysis of career trajectories of Chinese nanoscientists and engineers who are working on resource filtration and decontamination, with the intention of constructing a map of institutional (and hence geographical) locations of each scientist/engineer in the sample, in an effort to determine the effect of study and work abroad on collaboration networks and article quality (career trajectories will be mapped in space and time, using software built on top of Google Earth, to provide a visual representation of the evolution of the Chinese nano-community in this important field of research).

Future Research Plans (July 1, 2007 through December 2007)

- **China/Taiwan research:** Summer 2007 research in Taiwan and China will address three inter-related questions (1) What are the strengths and weaknesses of (and associated supports and barriers for) Chinese nanotechnology, in terms of innovation in research and eventual commercialization? (2) To what extent, and in what ways, does international collaboration fosters innovative R&D in China? (Interviews will be augmented by a statistical analysis of the determinants of high-impact journal publications; see below). (3) What is the impact of government support on innovation? (We are especially interested in better understanding whether heavy governmental “top down” support advances or impedes innovation and successful commercialization,) The research team will be comprised of Appelbaum, Gereffi, Parker, and Cong Cao (Senior Research Associate, Levin Institute). Interviews are being set up with firms, research parks, incubators, labs, etc. They include visits (in China) with Zhejiang University (CNSI-Zhejiang); Zhangjiang Hi-Tech Park in Pudong, Shanghai; Suzhou Nanotech Institute of the National Academy of Sciences, Ministry of Science and Technology and the Natural National Science Foundation, Beijing. In Taiwan we will visit the Industrial Technology Research Institute (ITRI), hosted by Dr. Tsung-Tsan Su, Executive Director of ITRI’s National Nanotechnology Program. ITRI is the state-sponsored organization responsible for technology development in Taiwan. (We have already conducted interviews with Dr. Sean Wang, president of ITRI International (San Jose, California; Parker will attend ITRI’s Forum 2007 (Innovation and Collaboration Across the Pacific), Santa Clara, CA (June 14, 2007).
- **China Nanotechnology Co-authorship – Data-Mining and Analysis:**
- **Center for Industrial Development and Environmental Governance:** (Parker, summer 2007 research on China’s use of nanotechnology to achieve environmental sustainability and realized the UN’s 7th Millennium Development Goal, focusing on the role of international collaboration and state policy. Supported by NSF East Asia and Pacific Summer Institute for Graduate Students (EAPSI)) Program
- **Begin setting parameters fir survey of nanotech clusters:** Research Triangle Park, NC; Silicon Valley, Santa Barbara, Los Angeles, California; Boston; Northern Italy. Purpose: to determine commercialization along the value chain (will build on survey conducted in northern Italy by Stefano Micelli and Vladi Finotto at Venice International University

Conferences (planned)

- **“Nanotechnology Occupational Health and Safety,”** November 15-17, 2007, UCSB (collaboration between UCSB, Harvard, UCLA) (Appelbaum, Harthorn)

Co-funding Submissions

- NSF East Asia and Pacific Summer Institute for Graduate Students (EAPSI): Parker (funded) – summer internship at the Center for Industrial Development and Environmental Governance (CIDE), School of Public Policy and Management, Tsinghua University, Beijing, China
- “Moving Up the Value Chain: Chinese/US Collaboration Networks for Environmental Remediation” (submitted to UC Pacific Rim Research Program: Parker--not funded)
- NSF PIRE: US-China-Taiwan Partnership in Research and Education on Design for Nanotechnologies-DFN: Tim Cheng (UCSB), lead PI; others from UCLA, China, Taiwan; Appelbaum, Harthorn among project directors (not funded)

New Collaborations

- **Chinese National Academy of Nanotechnology and Engineering (CNANE):** Dr. Xu Zhengzhong, Deputy President, senior visiting scholar at CNS-UCSB during various periods 2007-2009 (Dr. Xu’s research will serve to foster the exchange of scientific understanding about the leading ideas in nanotechnology and their application, while helping to establish a framework for future collaboration. (MOU signed.)
- **Venice International University**, through Gary Gereffi. Stefano Micelli, who is Dean at VIU (<http://www.univiu.org/aboutviu>) and Director of TeDIS (VIU's Center for Technologies in Distributed Intelligence Systems, <http://www.univiu.org/research/tedis/>) - and his colleague, Vladi Finotto, Adjunct Professor, Department of Economics, VIU - have been carrying out research on innovation and competitiveness of businesses in industrial districts on Northern Italy. They have surveyed firms in the region - including nanotech firms - focusing on the way that interfirm networks have created synergies that enable firms to flourish. (There is a strong geographical component to this.) They have been conducting this survey since 1999, and are currently working with Gary - and now me - to adapt it specifically to nanotechnology and a comparative framework that would include Research Triangle Park and, if we so decide, nanotech regions in California.
- **College of Textiles at North Carolina State University.** This is a collaboration Gary Gereffi has through a doctoral student there he is supervising, Stacey Frederick, who is doing her dissertation on nanotechnology in the textile industry in North Carolina. Stacy has completed a draft of a questionnaire we could use should we decided to do the comparative study mentioned in connection with VIU (she is adapting the VIU TeDIS instrument). The questionnaire determines the type of research being done, where it falls on the value chain, and the factors that shape its location (and competitiveness - i.e., it tries to get at issues around transaction costs and industrial districts).
- **Cong Cao, Senior Researcher, Levin Institute:** Dr. Cao has joined our working group and will be conducting research with us in China this summer,

DUKE SUBCONTRACT (Gereffi)

Research Projects

Summer 2006 – Secondary research was carried out by Stacey Frederick on the firms labeled by the North Carolina Department of Commerce as being involved in nanoscale research, development and commercialization. This information was used to map companies on the

nanotechnology value chain by various variables as a way to identify NC's footprint in nanotechnology.

July-August, 2006 – Field research by Gary Gereffi and Ryan Ong in China with CNS-UCSB research team (Rich Appelbaum, Rachel Parker, Yiping Cao. (see above description)

Ongoing research, 2006-07 (Stacey Frederick and Gary Gereffi) – “How Nanotechnology Can Enhance Textile Products Throughout the Value Chain.” Nanotechnology can impact the textile industry in many different ways, including nanometer thick coatings, replacing larger fibers with nanofibers, using untraditional nanomaterials such as carbon nanotubes, or by adding nanoparticles to fibers or finishes that are then applied to existing textile products. Our goal is to intertwine the nanotechnology value chain with the textile value chain to identify opportunities for textile companies in advanced economies to upgrade in the global economy by adding nanoscale attributes to their products. Future research will include interviews with textile firms in North Carolina already pursuing nanotechnology as a way to differentiate their products as well as with firms outside the textile industry to understand the many ways in which nanotechnology offers an avenue for crossover between different industries.

Meetings, Conferences, and Workshops

Meeting with Jonathan Pierpan (Legislative Assistant, NC Senator Richard Burr) – Feb. 22, 2007 at CGGC, Duke University.

Participants: Melissa Vetterkind (Duke Office of Federal Relations), Mary Matthews (Duke Health System Office of Government Relations), Mark Wiesner (Pratt School of Engineering), Ryan Ong (Duke Center on Globalization, Governance & Competitiveness), and Stacey Frederick (North Carolina State University). Discussion covered an overview of nanotechnology and its social/environmental impact, as well as the US Congress's new bipartisan Nanotechnology Caucus. Wiesner discussed the legislative and regulatory status of nanotechnology, especially in contrast to genetically modified organisms (GMO). Frederick and Ong led a discussion on the state of the industry in North Carolina, including nanotechnology centers and companies, its interaction with traditional North Carolina industries like textiles/apparel, and the relative lack of venture capital. The group also discussed major barriers and policy needs for the industry, including immigration policy, intellectual property laws, and safety regulation.

Second Annual Nanotechnology Conference <<http://www.ncnano.com/>> –

Stacey Frederick served on the planning committee for North Carolina's second annual nanotechnology conference that aims to bring together entrepreneurs, executives and investors. This will serve as an opportunity to create a network with the nanotech community in NC to support future collaborative research on North Carolina's projected path in nanoscale research and commercialization and its impact on NC's economy.

Duke University, Nanotechnology Workshop, March 29-30, 2007

Organized and supported by Gary Gereffi, Director, CGGC, Duke University – This workshop brought CNS-UCSB researchers together with international colleagues from working on nanotechnology at the Levin Institute and Venice International University, along with nanotechnology firms and policymakers in North Carolina who are attempting to bridge the divide from innovation through commercialization of nanotechnology projects.

PAPERS AND ARTICLES

- Appelbaum, Richard P. (2007) “Survey of Participants, NSF-Sponsored US-China Workshop on Nanotechnology, March 22-24, 2006” (2/15/07): internal report to NSF, based on survey of 20 Chinese and 20 US conference participants, evaluating conference and soliciting suggestions for future conferences
- Appelbaum, Richard P. and Rachel Parker (2007) “Innovation or Imitation? China’s Bid to Become a Global leader in Nanotechnology” (under review)
- Appelbaum, Richard P., Gary Gereffi, Rachel Parker, and Ryan Ong (2006) “From Cheap Labor to High-Tech Leadership: Will China’s Investment in Nanotechnology Pay Off?” CNS working paper (June 26)
(http://www.cns.ucsb.edu/index.php?option=com_remository&Itemid=100&func=startdown&id=13)
- Gereffi, Gary and Ryan Ong (2006). “Upgrading in the Global Knowledge Economy: Insights from China and India.” Conference Paper, prepared for Global Value Chains Workshop, “Industrial Upgrading, Offshore Production, and Labor.” Durham, North Carolina: Center on Globalization, Governance & Competitiveness, Duke University (November 9-10).

Presentations

- Appelbaum, Richard P. (2006) “From Cheap Labor to High-Tech Leadership: Will China’s Investment in Nanotechnology Pay Off?” Presidential panel, annual meetings of the Society for the Advancement of Socioeconomics (SASE), Trier, Germany (June 30-July 2)
- Appelbaum, Richard P. (2007) “Innovation or Imitation? China’s Bid to Become a Global leader in Nanotechnology,” Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies, program on Nanotechnology in China: Ambitions and Realities, Washington, D.C. February 6) powerpoint and webcast available at http://www.wilsoncenter.org/index.cfm?fuseaction=events.event_summary&event_id=218854
- Appelbaum, Richard P. (2007) “China’s Bid to Become a leader in Nanotechnology,” UCSB Department of Geography Colloquium, Santa Barbara, CA (March 8)
- Appelbaum, Richard P. (2007) “China’s Bid to Become a leader in Nanotechnology,” Chancellor’s Community Breakfast,” Santa Barbara, CA (March 19)
- Appelbaum, Richard P. (2007) The Impact of Ending the Multifibre Arrangement on Apparel-Exporting Developing Countries – With a Brief Detour into China’s Emergence as a High-Tech Power, and Some Possible Implications for Developing Countries,” Watson

- Institute for International Studies, Brown University, conference on “The Rise of the New Asian Giants: Adaptive Strategies in the Global Economy” (April 13)
- Appelbaum, Richard P. and Rachel Parker (2007) “China’s Move Into Nanotechnology: The High Road to Development,” East Asia Center, University of California at Santa Barbara (January 30)
- Appelbaum, Richard P. and Rachel Parker (2007) “Nanotechnology in a Global Context: The Case of China,” Center on Globalization, Governance, and Competitiveness, Duke University conference on The Global Knowledge Economy: Current Issues and Trends in the United States, East Asia, and Europe (March 29-30)
- Gereffi, Gary and Ryan Ong (2006). “Upgrading in the Global Knowledge Economy: Insights from China and India.” Presentation. Global Value Chains Workshop, “Industrial Upgrading, Offshore Production, and Labor.” Durham, North Carolina: Center on Globalization, Governance & Competitiveness, Duke University (November 9).
- Gereffi, Gary, Stacey Frederick and Ryan Ong (2007). “Nanotechnology in North Carolina.” Presentation. “Nanotechnology and the emerging global knowledge economy: Challenges and opportunities in an international context.” Durham, North Carolina: Center on Globalization, Governance & Competitiveness, Duke University (March 29).

Year Two Report for Working Group 2
Innovation, Diffusion, and Global Development
Innovation Group
July 2006 - December 2007
Chris Newfield, Leader

Team members: Gerald Barnett (UC Santa Cruz), David Mowery (UC Berkeley), Suzanne Scotchmer (UC Berkeley); Students (all UCSB): Kim Stoltzfus, Communication; Gerald S. Macala, Chemistry; *Name Withheld*, Chemistry, Alan Glennon, Geography; *Name Withheld*, Sociology

Background

In spite of indicators that the U.S. retains a leading position in nanotechnology-related innovation, reports and studies released in the past year suggest reasons for concern. Even areas of special strategic interest may not be receiving adequate funding or structural development: a recent National Research Council report found, as one example, that the NSF’s material sciences program is funding only about 10% of applications, and that the average material sciences center conducts about 70% of the research it supported ten years ago (*Looking Back, Moving Forward*). In 2006, the legislative and executive branches responded with the National Innovation Act (NIA) (S.2109, the Protect America’s Competitive Edge (PACE) bills (S 2197, S.2198, S.2199), and the Bush Administration’s American Competitiveness Initiative). These measures share an emphasis on major increases in federal research money, industry tax credits, visa reform for employment- and education-based categories, and improvements in science and technology education. More funding for instruction and research will certainly help expand the innovation system and reduce bottlenecks. But the public discussion focuses on quantity, and does not address the quality and function of the innovation system and its standard practices. Many economic hopes rest specifically on nanotechnology, a term still usually deployed in the singular,

and yet the most systematic recent official assessment of its *economic* impacts was tentative and mixed (Committee to Review the National Nanotechnology Initiative, National Research Council, *A Matter of Size: Triennial Review of the National Nanotechnology Initiative*, 2006, esp. Section 3).

The Innovation Group seeks to add to scholarly knowledge and public discussion by examining several structural features and core design elements of the nanoscale innovation system. We are concentrating on two major domains, both of which are widely regarded as crucial to innovation. The first is the *university-industry interface*, and the second consists of *cross-institutional collaborations*. In the former, we examine the institutional mechanics by which technology is transferred from the university to industry; the effects of intellectual property rights in the context of new and emerging hybrids of ownership, conditional use, and open access; and the research communities that emerge (or fail to emerge) across a range of different institutions. In the second domain, we evaluate the range of factors that enable or impede collaboration across disciplines and institutional barriers. These two domains are related in that research in most or all nanoscale disciplines requires collaboration across the university-industry divide, and the interactions between technology transfer policies and institutional practices determine the effectiveness of research collaborations.

Our long-term goal is to improve the operation of nanoscale innovation systems for any given level of funding and training. A secondary long-term goal is to align technological with socio-cultural requirements.

In 2006-07, we have been addressing these two domains through the research programs described below.

1. Mapping Nanoscale R&D Networks. This year we conducted the following research:

a) reviewed and created an inventory of existing databases of nanoscale research centers in academia and industry. The databases reviewed include those by Lux Research and the Wilson Center, in addition to ones produced by academic research teams (Vincent Mangematin in Grenoble, Philip Shapira and Jan Youtie at Georgia Tech, Lynn Zucker and Michael Darby at UCLA, and Tim Lenoir and Eric Giannella at Duke, among others). We have found these databases useful but incomplete, and in any case do not wish to duplicate them.

b) decided to develop focused but comprehensive maps on specific regions and nanotechnologies.

c) to this end, completed a list of over 450 nanoscale research centers in California, both industrial and academic. This includes industrial and academic centers.

d) prepared a Google Earth template for the visualization of the relationships among these centers.

e) began a mapping study of quantum dot patents 1989-2006, using Sci Finder in conjunction with a partial data set obtained in collaboration with Shapira and Youtie at Georgia Tech.

Our goals here are to produce interactive maps for (1) California across technology areas; and (2) for our technological focus of quantum dots in all regions of the world. Users will be able to link patents, publications, and individuals, identify locations and collaborative relationships. We aim

to be able to follow funding patterns and to identify patterns in the particularly important and yet poorly-recorded area of industry licensing, patenting, and development.

We have identified nearly 3000 quantum-dot patent filers and as of the end of June 2007 are working on automating the correlation of eight variables in the patent data. The work is progressing, though we have found that correlations are difficult to automate in a way that produces clean and reliable data; the latter has require labor-intensive manual reading and sorting. This work will continue in 2007-08, and we will more systematically compare the results of commercial patent data searches as well as develop our collaboration with the Shapira group that is working with CNS-ASU. Closer collaboration with Tim Lenoir and Eric Giannella will also help us work around the methodological issues that affect all of us working in the field of nanoscale patenting.

1a. Website Link Analysis: VOSON Collaboration (via WG3)

The Innovation Group developed international seed lists of four types of nano-related organizations - government funders (36 central government agencies), universities (the 21 most-published universities - most with multiple labs - in nano-categories in Sci Finder, 2006), industry-based (75), and non-governmental organizations (15). We handed off these lists to Bruce Bimber and his collaborators at Australia National University, who will program the sites we provided into software that builds network maps of Internet site interlinkages. The programming has begun and in 2007-08 we will analyze preliminary results to determine what kind of on-line connections are being made among institutions in distinct sectors (NGOs and industry, for example).

1b. Networks and Nanoscale Innovation.

The mapping project (1) identifies people, patents, publications and their formal interrelationships. The web project (1a) identifies Internet-based connections among various types of nano-oriented organizations in a global framework. And yet questions remain: What is the content of these diverse kinds of relationships among heterogeneous institutions? More specifically, how do they affect rates of innovation among practitioners?

To begin to answer these questions, we are using two additional methodologies - survey research, and interviewing. We describe the interviewing - which focuses on the university-industry interface - in Project 4 below.

In the Spring of 2007 we developed a survey on the topic of “Networks and Nanoscale Innovation.” Approximately twelve pages long, it asks demographic questions, nano-identification and lab-placement locators, and then a series of questions about collaborative relationships, communication across institutional lines, and the uses of and attitudes toward information gathered from other disciplines. The survey is to be piloted and then administered on-line in the Summer of 2007, with invitation lists selected from a range of academic institutions and a systematic sample from laboratories previously identified as nano-related and non-nano related (20 of each type).

The core question we are addressing is whether nanoscale collaboration patterns differ in meaningful ways from those in non-nano identified laboratories (from the same set of formal

disciplines). Secondary questions concern differing attitudes and communication skills. As one example, will nanoscale research require researchers to have more developed interpersonal or rhetorical skills in order to work more intensively with people from other fields? Data analysis will take place in Fall 2007.

2. Media Discourse Study.

This is another experimental collaboration with WG3. Using their media coverage analysis methodology, we began in February 2007 to conduct monthly downloads of all Google News records in which selected variants of nano* occur in conjunction with four key terms: Risk, Innovation, Protest/Advocacy, and Equity/Social Justice (our acronym is RIPE). We presented preliminary data at our April 2007 site visit. Risk and innovation appear with some frequency, though “innovative” is often a non-substantive synonym for adjectives “good” or “new.” So far, it appears that nanotechnologies are not triggering discussions about innovation in English-language media.

3. Group Creativity in Nanoscale Research.

Through August 2006, the group conducted the following activities:

1. a comprehensive review of the communication literature on group creativity (n = 170)
2. comprehensive bibliographic development of non-communication group creativity literature (n = 400)
3. a search for studies of group creativity in nanotechnological research (final n = 0)
4. full annotation and coding of (1) and (2)
5. construction of a matrix of creativity variables from (4) (n = 60)

The literature review produced interesting suggestions for dominant variables in the creative process. But the results were inconclusive. This result, coupled with the Center’s funding cuts, has caused us to terminate this research stream.

4. Technology Transfer at the Nanoscale

This stream is currently the centerpiece of the Innovation Group’s current research. It focuses on the mechanics of moving nanoscale inventions from research into development. In 2006-07, Newfield and his principal collaborator on this research stream, Gerald Barnett, reviewed the current literature on the topic and analyzed the full range of conventional statistical analyses of tech transfer output (some of the results will appear in Newfield’s book, *the Post-Industrial University* [Harvard University Press, 2008]). On the basis of this review, we hypothesized that the traditional tech transfer metric of success - licensing revenue - understates research invention and underfunds the research consortia that were crucial to biotech research and that appear equally important to nanotechnologies.

Our first test of this hypothesis involves interviews with technology managers and practitioners to determine both attitudes towards transfer, licensing, consortia, and collaborations, as well as actual relationship networks. We have established two sets of protocols for a range of interviews (total n = 80), to be conducted in two rounds. The first round focuses on two groups: technology managers and principal investigators who are involved in nanoscale research. The first round has only five questions and takes 15-20 minutes to conduct. Our questions are as follows:

1. What characterizes "nanoscience" and "nanotechnology"?
2. Who are your campus leaders (programs and individuals) conducting nanoscience research?
3. What distinctive resources or practices does nanoscale research require?
4. If you could change technology management to enhance the impact of your or your institution's nanoscience research, what would you change?
5. Who do you think is doing the best nanoscale research (including work that's not been widely recognized)? Who is doing interesting technology transfer or management of that research? (Please include a description of your relationship with the people or programs.)

Results thus far suggest that our approach yields interesting substantive information on tech transfer procedures and useful network information (thus complementing the projects described above). It also appears to be establishing a basis of trust for conducting the second round of research - to start in Fall 07 - with a full set of questions that will run approximately 90 minutes.

5. Intellectual Property Effectiveness at the Nanoscale

This project involves our off-campus collaborator Suzanne Scotchmer (Economics and Public Policy, UC Berkeley). It will examine the quantum-dot patent record for "trolling" and "hold-up" behaviors. Although many analysts are concerned that most nanoscale patenting is premature, defensive, and strategic, and could thus damage long-range development, our interviews (4 above) suggest much confidence that industries that have managed to assemble hundreds or thousands of patents in order to manufacture a common product like a DVD player will overcome the patenting complexities created in various nanotechnologies' early stages. This study will attempt to establish an objective basis for this confidence, or qualify it. This project has not begun, as it awaits systematic data as described above.

Findings

1. Mapping: the nanoscale research enterprise is large and complex but disaggregated. Current attempts to identify clear, linear trends in "nanotechnology" are not readily sustained by the actual state of the evidence.

1a. VOSON Web links: in process

1b. Networks survey: in process

2. Media Study: Public coverage of nanotechnologies is still conceptually rudimentary, and nanotechnologies are not yet identified with a substantive notion of innovation.

3. Group Creativity (terminated): enablers of organizational creativity are phase-specific: for example, an enabling feature of group interaction in early-phase research can become a constrainer in product development.

4. Technology Transfer Policy: most technology managers believe that product incentives will eventually overcome the limitations of the current university-industry interface for nanoscale research, as they believe they have with prior technologies.

Publications and Presentations

With the exception of Newfield's forthcoming book (2008), noted previously, none of the participants' publications or presentations this year were supported by this NSF grant, and are thus not listed here. In large part this is due to the technicality that the off-campus members of the group have not yet spent any of their CNS funds, which they are saving for the hiring of an effective student group.

Research Plans for 2007-08

1, 1a, and 1b: Mapping and Network analysis:

- continued data and mapping development
- collaboration and partial integration with related non-CNS mapping projects
- network analysis of Internet links among a range of institutions
- piloting and administration of large scale nanoscale network survey
- analysis of survey results comparing nano and non-nanoscale network practices.

2. Media Discourse -

- Continuation of monthly downloading and content analysis

3. Creativity - Terminated

4. Next Generation Tech Transfer:

- completing of first round interviews (n = 40): Fall 07
- analysis of first round interviews
- second round interviews (Fall 07 - Spring 08).

5. Intellectual Property Effectiveness at the Nanoscale

- analysis of patenting patterns in selected application areas (Spring 08)

Publication and Outreach, 2007-08

Project 1 will yield maps and related information available on-line to the public.

Project 4 will produce 1-2 articles on nanoscale technology transfer policies to be submitted to the relevant journals.

The projects taken as a whole are already the subject of submissions to opinion pages and other forms of mass media, and these efforts will continue.

Concluding Remarks

Overall, 2006-07 was a year of internal development, and we were focused more on building our own operations than on publication and other forms of communication. We successfully formed a genuinely interdisciplinary working group with graduate students from the social sciences and natural sciences working side by side. By “genuinely,” we mean that the Innovation Group went well beyond the first step of interdisciplinarity: we moved from the stage in which the PI serves as a hub that condenses the inputs from team members that represent various disciplines into a template defined by an established discipline, and on to a stage in which each team member acted in effect as the PI for particular subject matter, and where the research template crosses disciplinary lines and rapidly develops new questions and approaches. For example, the Communication grad student functioned as the survey research expert, the Bioinorganic Chemist as a specialist in patent data mining, and in each case the particular lead had to have expert knowledge and also rely on the rest of the team to point out sometimes awkward gaps in knowledge and to then fill them in. The group also had to negotiate the termination in September 2006 of a very prominent expert collaborator; rather than attempting to replicate his expertise, we grew around it and in new directions. Newfield was always responsible for agenda-setting, work flow, orchestration of information, and synthesis, as well as for serving as the expert lead in all aspects of the technology transfer research. And yet the learning process was multidirectional, and every member of the group contributed novel ideas at critical moments. Interdisciplinary research takes time to set up, and requires careful negotiation at transition points, but the final decisions are better and the work product richer and more enduring as a result. This kind of collaboration also allows a group to learn quickly from mistakes. The structure of our thinking has evolved with surprising speed over the course of the year, and that is owing to a successful group dynamic which we will continue to develop in 2007-08.

**Year Two Report for Duke University Sub-Contract
Working Group 1 and Working Group 2
July 2006-December 2007 Activity
By Timothy Lenoir**

Team members: Tim Lenoir (Professor, PI Duke Subcontract to CNS) and Eric Giannella (Research Analyst, Duke Subcontract to CNS)

Following completion of the work reported upon for this period, Eric Giannella has left the project to enter a graduate program. I am in the process of replacing Eric with a new research analyst.

Summary of work performed:

During Year 2 we continued our work on developing tools for tracking emerging fields in nanotechnology using citation and document clustering methods. We also continued our work on developing efficient approaches to visualizing these clusters and the development of fields over time. This problem is particularly thorny, because while it is relatively straightforward to use citation and patent data to cluster documents, it is difficult to represent the structure of the research areas clustered in intuitively useful visual representations. We have worked on that problem extensively, and we have written up our preliminary results in a paper, which is attached to this report.

A general approach we have pursued is to develop methods for tracking the emergence and development of what practitioners refer to as “technology platforms.” A technology platform is an ensemble of technologies, including a foundational core technology which comprise a set of subsystems and interfaces that form a common structure. From this common structure a stream of derivative products can be efficiently developed and produced. We argue that the notion of a technology platform is particularly pertinent to analyzing emerging new domains, such as bionanotechnology, where the dynamics of the field arise from transdisciplinary convergences drawing upon different research streams and a heterogeneous mix of tools and concepts rather than evolving out of a single theoretical or technical core. Unlike biotechnology, which is concentrated in a few classification categories, patents in nanotechnology span more than 214 categories of the USPTO classification scheme. In our view a more robust method for tracking the emergence of new technologies is to examine their footprint in the marketplace. Technology platforms offer a way to address this phenomenon. Our goal is to summarize these developments in two papers. The first paper, now circulating among colleagues, does not focus explicitly on a nanotechnology field, but develops the notion of a technology platform and illustrates the methods for detecting and tracing its evolution in connection with RFID tagging, which is a relatively dispersed recent technology that fits our need for a manageable data set for our quantitative model. In a follow-on paper we plan to apply the same approach to examining the emergence of quantum dot technologies. We also intend to explore work going on in the large area of carbon nanotubes.

In addition to working on these general methodologies in support of CNS projects, Eric Giannella supplied new maps and visualizations representing the migration and collaboration patterns among a subset of spintronics researchers. McCray has incorporated these into his presentations and publications in preparation for the CNS.

I began discussing ways to collaborate with Gary Gereffi, from Working Group 2, to apply our mapping and visualization approaches to the investigation of the diffusion of nanotechnology in North Carolina. I applied for a research award locally at Duke to support this effort (discussed below).

In addition to working on these general methodological issues that are relevant to several projects of other CNS working groups, Lenoir has been reading and gathering sources for investigating the development of bionanotechnology, an area that is particularly dependent on nanotech approaches.

Products from Working Group One Research for Year Two

In addition to the data analyses, mapping and visualization of spintronics research completed for McCray’s project (described in WG1 Research Section), we have conducted research and written a paper on the notion of technology platforms in emerging technologies, taking RFID tagging as our case example for reasons of quantitative manageability. The paper is attached.

In addition the paper on technology platforms Lenoir completed a paper on more general societal and ethical themes related to concerns about the fusion of information technology,

biotechnology, and nanotechnology that have led some scholars to think about a “posthuman” future. Lenoir has presented this paper two times and is in the process of revising it for publication in an edited volume.

Presentations:

Below is a cumulative list of presentations made by Lenoir during 2006-07 related to effort undertaken as part of the CNS project:

- “Visual Mapping of Nanotechnology Networks,” November 2, Messy Shapes of Knowledge, Annual Meeting of the 4S Society, Vancouver, BC, Canada, November 1-5, 2006.
- “Visual Mapping of Nanotechnology Networks,” presented at the annual meeting of the Center for Genome Ethics Law and Policy at Duke University, March 23, 2007.
- “Visual Mapping of Nanotechnology Networks,” March 29, Nanotechnology and the Emerging Global Knowledge Economy: Challenges and Opportunities, Duke University, March 29-30, 2007
- “Contemplating Singularity: On Nanomachines and Postbiological Selves,” April 21, Interfaces and Visualizations: A State-of-the-Art Conference on the Humanities in Post-human Times, University of Illinois, April 20-21, 2007.
- “Contemplating Singularity: On Nanomachines and Postbiological Selves,” May 26, Media, Technology, and Society Program, Northwestern University School of Communication.
- Joint Wharton-Chemical Heritage Foundation Symposium on Social Studies of Nanotechnology, Wharton School, University of Pennsylvania June 7, 2007, Commentary on papers by Hyungsub Choi and Cyrus C.M. Mody and Frank Rothaermel and Marie Thursby.
- Strategies for Data Mining, Mapping and Visualization of Emerging Nanotechnologies, June 18, lecture to the Visualization Group, at the Zentrum für Interdisziplinäre Forschung (Zif), Bielefeld, Germany.

I also applied for grants from the NSF and from the Duke University Provost’s Common Fund to support further development of our projects. The NSF application was to the SES (Studies of Policy, Science, Engineering and Technology) program at the NSF. The proposal was declined, but we were encouraged to revise and resubmit. I am planning on resubmitting the proposal for the August 15 deadline. The application to the Duke University Provost’s Common Fund was successful. In part it supports my efforts to work closely with Gary Gereffi on mapping value chains in manufacturing related to nanotechnology, particularly in North Carolina. The project includes a group of colleagues from Computer Science and Engineering at Duke working in graphics and visualization. We also plan to map global value chains in nanotechnology. The grant is for one year.

**Year Two Report for Working Group 3
Risk Perception and Social Response to Nanotechnologies
Barbara Herr Harthorn and Bruce Bimber
Jul 2006 – Dec 2007**

WG3 has a multi-level approach to perception and response to emerging nanotechnologies that examines individual risk perceptions, key stations for amplification and attenuation of risk,

particularly media, and social response at the group level. The Social Amplification of Risk Framework (SARF) provides one framework for understanding the issues across these levels of analysis. Our work also draws on theories of media framing and political communication. The approach has a temporal dimension as well, in which we assess the extent to which existing templates for analyses of other technological controversies provide a model for the analysis of nanotechnologies. WG3 has one team focused on risk perception and public deliberation and another team focused on media.

Risk perception and public deliberation team

Led by: Barbara Herr Harthorn

Team members: Karl Bryant (CNS Soc Sci Grad Fellow 06-07), Joe Conti (CNS Soc Sci Grad Fellow 07-08), Tyronne Martin (CNS Sci and Eng Fellow 07-08), Alexis Ostrowski (CNS Sci and Eng Fellow 07-08), Joe Summers (CNS Sci & Eng Grad Fellow 06-07) Francesca Bray (Edinburgh Univ, UK), Milind Kandlikar (University of British Columbia), Nick Pidgeon (Cardiff University, UK), Tee Rogers-Hayden (University of East Anglia, UK), Terre Satterfield (University of British Columbia),

Media team

Led by: Bruce Bimber

Team Members: Erica Lively (CNS S&E Grad Fellow 07-08), Gerald S. Macala (CNS S&E Grade Fellow 06-08), David Weaver (CNS Soc Sci Grad Fellow 06-08)

Robert Ackland (Australian National University), Mathiu O'Neil (Australian National University)

1. RESEARCH ADMINISTRATION

A. Collaboration, Meetings, Project Administration

Risk perception and public deliberation

This research group includes a multinational, interdisciplinary team co-led from the UK (Pidgeon), Canada (Satterfield), and the US (Harthorn). The full team has frequent interaction via teleconferences and e-mails and plans to meet ftf at least once a year. In 2006-07, group meetings took place in Oct-Nov in Vancouver and in The Hague, Netherlands, in June 2007 in conjunction with a high profile research panel we organized and presented at the SRA-E (Society for Risk Analysis-Europe) meetings; we will meet again at the 4S meetings in Montreal in Oct 2007, where we are also presenting multiple papers in a CNS-organized panel. Although the 3 co-leaders are involved in the conceptual end of all the research, for the two projects this year, Pidgeon and his team have taken the lead on the public deliberation research with strong participation from Harthorn and the CNS team at UCSB, while Harthorn and Satterfield are co-leading the nanotech expert risk perception study. All 3 team co-leaders are unusually experienced in mixed methods social and behavioral science research with expertise in qualitative research (interview, ethnography, focus groups, cultural analysis) and quantitative methods (experimental and survey research). All 3 have interests in risk perception and race/class/gender social equity issues as well as environment and health. Bray is an expert on gender and technology in China and the West and will become more involved in WG3 research in years 3-5; Harthorn has monthly conference calls with her.

Pidgeon has significant co-funding for this research with a large multi-year Leverhulme award to study energy technologies and is contributing his time to this research from his Cardiff support. He also represents the CNS on the IRGC and many other key panels. Satterfield and Kandlikar are both contributing their own and some graduate student support to the project. Harthorn received co-funding in 2006 (as co-PI) for a related project that surveyed international industry safe handling practices for nanoscale materials. Harthorn is PI on a pending subcontract from CNS-ASU for conducting a Santa Barbara site for the national consensus workshops planned for Mar 2008.

Media

We have formed a research partnership with Australian National University (ANU), under the working title Virtual Observatory for the Study of Online Networks (VOSON). VOSON is using webcrawling and network-analysis tools to identify online networks engaged in discussions or political action regarding nanotechnology, and to identify the structure, location, and interlinkages among non-profit, NGO groups engaged with nanotechnology issues.

The VOSON collaboration is based at ANU at the Center for Social Research, Research School of Social Sciences, and has recently been funded by the Australian Research Council (ARC) for the purpose of developing tools for examining online networks addressing nanotechnology and to identify the structure, location, and interlinkages among non-profit, ngo groups engaged with nanotechnology issues. Bimber is a co-PI on that grant, which funds collaboration between the ANU group and the UCSB group. Under the ARC grant, Bimber visited ANU in August 2006 for research meetings and to give a plenary address on nano and society issues. VOSON researchers at ANU and collaborators in the United Kingdom at Oxford and Leicester University are using collaboratively produced data for analysis and preparation of research reports.

B. Graduate Students

The CNS-UCSB supports several graduate fellows who are assigned to the teams in this Working Group. In 06-07 and 07-08 that includes Karl Bryant (PhD Candidate, Sociology, 06-07), Joe Conti (PhD Candidate, Sociology, 07-08), Tyronne Martin (PhD student, Chemistry, 07-08), Alexis Ostrowski (PhD Candidate, Chemistry 07-08), Joe Summers (PhD Candidate, Engineering, 06-07), David Weaver (PhD student, Political Science, 06-08), and Gerald S. Macala (PhD Candidate, Chemistry, 06-08). All students have worked/are working across WG3 research projects, providing essential intellectual, scholarly, methodological, and practical contributions to the full international teams' efforts throughout this time.

2. RESEARCH TASKS COMPLETED

We have engaged in research on four main fronts over the past year since the last annual report, with particularly intensive activity in the risk perception and response areas. The focus there has been primarily on two streams of qualitative research, using interview and quasi-focus group methods, both of which we see as necessary preludes to the quantitative survey research we plan to follow. In the area of media, we completed our first year of collecting records of English-language media accounts of nano, and piloting a web-mapping technique.

A. Data Collection

i. Expert Study (*Risk perception and public deliberation*). In Year 1 we initiated an ethnographic and interview based study of nanoscientists and engineers, nanotoxicologists, and nano-regulators in order to develop an understanding of diverse expert judgments about risks of different nanotechnologies as well as scientists' views of the public, risk acceptability, nano governance issues, and valuation issues. We used a mixed ethno-scientific and mental models approach in developing the interview instruments for these different populations. Beginning with this work has also served to increase the nanoscience literacy of the social science research team, and working with our Engineering fellow (Summers) has been invaluable in that process. Harthorn's team has taken the lead on the academic nanoscale science and engineering interviews, while Satterfield is leading on the nanotoxicologist and regulator interviews. We also have some regional focus to reduce travel time and costs.

Academic nanoscientists. We began with a local UCSB nanoscience sample but will use networks to complete a purposive sample organized by gender, rank, and discipline. Between July and Jun 2007, 14 academic nanoscientists were interviewed by Harthorn and Bryant and preliminary findings presented at the 4S and SRA-E. The interviewing paused during the intensive deliberation research period, but we plan to complete this phase of data collection by July 2007 and expect to complete a research paper for review by the end of summer 2007.

Satterfield and Kandlikar have been working on the expert study and are also looking at key problems in risk assessment and regulation as understood by toxicologists and policy agents. We are in discussion about a possible web-based survey to extend this research. They have conducted an initial set of interviews and plan to complete up to 20 interviews before the end of year 2. With CNS support Satterfield and Kandlikar recruited a new PhD student (Christian Beaudrie) at UBC to begin Sept 07; his sole project will be understanding innovations in risk communication in the early stages of nanotechnology development. Together with Harthorn and Pidgeon, they have also begun work on developing a US national survey aimed at understanding emerging perceptions of risks as they come to be understood in reference to analogous prior cases of technology innovation and development. We are considering seeking co-funding for a comparable comparative survey in the UK.

ii. Public Deliberation Study (*Risk perception and public deliberation*). This same year-long period was extremely intensive for the deliberation research. We jointly developed a pilot protocol for a full-day workshop event focused on health and human enhancement technologies, developed and collected informational materials to use in conjunction with the event, and piloted in the UK in Oct 2007 (Pidgeon and Rogers-Hayden) and in Canada in Nov 2007 (the full team). On the basis of those pilots, we made significant modifications—reduced the time to avoid participant exhaustion, developed new technical materials presentations, and held a 3rd pilot in Santa Barbara in Jan 2007 (Harthorn, Bryant, and Summers). We then created a new energy protocol and materials following the health protocol in format, and held 4 groups in the US and UK sites in mid-Feb 2007, focused on the 2 different kinds of nanotechnologies (Health/Human Enhancement and Energy). Data analysis is well along, and we are developing 2-3 journal articles for completion by the end of 2007. We (Rogers-Hayden and Bryant) will be presenting

preliminary results on the cross-national comparison at the 4S meetings in Montreal. The cross-technology results are also being developed into a journal article.

We are also planning, contingent on a pending supplemental funding request to the NSF from CNS-ASU, to become a site for a reconvened consensus workshop in March 2008 which will give ASU's team a needed West Coast site for their national project and which will provide us with comparative data on a similarly recruited group in the same locale with our already completed deliberative workshops here (and by extension, the UK).

iii. Media Events and Framing Study (*Media*). We have completed on target a year of data collection of English-language media coverage of nanotechnology in society. Our dataset includes about 1700 articles, identified and content-coded using Lexis-Nexis and Google News. To collect this data we created and validated a search-term protocol, and developed custom software scripts for automating repeated large-scale searches of Google News. This data collection proceeds continuously during year two.

iv. Advocacy Networks Online Study (*Media*).

With our VOSON collaborators we successfully piloted and reported a web-crawler-based technique for studying the web-space topology of environmental organizations and their engagement with nanotechnology issues. With that pilot complete, we are now planning a broader study with Working Group 2 under Newfield to examine the topology of web links among government agencies, university labs, corporate groups, and a range of NGOs. The goal of this project is to identify how web sites as a medium serve to convey dialogue and frames about nano, and to identify key notes in the flow of information online about nano.

B. Publications

Risk perception and public deliberation

Harthorn, Barbara Herr, McCray, Patrick & Satterfield, Terre. "Anthropological Research at the UCSB Center for Nanotechnology in Society," *Practicing Anthropology* (special issue on nanotechnology) 28, 2 (2006): 38-40.

Rogers-Hayden, T. & Pidgeon, N. "Reflecting upon the UK's Citizens' Jury on Nanotechnologies: *Nano Jury UK*." *Nanotechnology Law and Business* 2, 3 (2006):167-178.

Pidgeon, N.F. Opportunities and uncertainties: the British nanotechnologies report and the case for upstream societal dialogue. In K. Andersson (ed.) *Proceedings of VALDOR-2006*. (Stockholm:Congrex Sweden, AB), (2006) pp. 371-378.

Pidgeon, N. "Risk and Uncertainty." In *Trust in Science: The Dialogue with Society*. Berlin: Ernst Schering Foundation and the British Council, (2006) pp. 40-45.

Harthorn, Barbara Herr. "Nano-Buzz: Societal Dimensions of Emerging Technologies." *Anthropology News*, October (2006): 26.

Kandlikar M, Ramachandran G, Maynard A, Murdock B, Toscano W. "Health risk assessment for nanoparticles: A case for using expert judgment." *Journal of Nanoparticle Research* 9 (1) Jan (2007): 137-156.

- Rogers-Hayden, T. & Pidgeon, N. 2007 Moving Engagement “Upstream”? Nanotechnologies & the Royal Society and Royal Academy of Engineering’s Inquiry, Special Issue, *Public Understanding of Science*, 16:345-364.
- Rogers-Hayden, T. & Pidgeon, N. *In Press*. Developments in Public Participation in Nanotechnology: towards Sustainability. In H Kastenholz and A Helland (eds.) Nanotechnology Development in Light of Sustainability. Special Issue of *Journal of Cleaner Production*. Expected 2007.
- Pidgeon, N. & Rogers-Hayden, T. “Opening up Nanotechnology Dialogue with the Publics: Moving Beyond Risk Debates to ‘Upstream Engagement’.” In A. Anderson, A. Petersen, S. Allan and C Wilkinson (eds.) Special Issue *Health, Risk & Society*. 9, 2 (2007):191-210.
- T. Rogers-Hayden, A. Mohr, D. Guston, N. Pidgeon and B. Wynne (Eds). (*In preparation*). *Engaging with Nanotechnologies-Engaging Differently? Special Issue of Nanoethics* (Due July 2007).

Media

- Ackland, R & O’Neil, M. “Nanotechnology and Online Environmental Activism.” Article manuscript under review at the *American Sociological Review*.
- Weaver, D. & Bimber, B. “Measuring News Events: A Comparison of Searches Using Lexis-Nexis and Google News.” Article manuscript under review at *Political Communication*.
- In preparation:
- Bimber, B. & Weaver, D. “Media Response to an Emergent Issue: Indexing and Framing Under Uncertainty in the Case of Nanotechnology.”

C. Presentations Jul 2006 – Dec 2007

- Rogers-Hayden, T. & Pidgeon, N. “Nano Jury UK: the ‘Evaluators’ Perspective,” Guest workshop participant, Citizen Participation in Science and Technology: How to Design and Organize Deliberation, Citizen Participation in Science and Technology (CIPAST) Dresden. June 26-28, 2006.
- Pidgeon, N. “Trust, Risk and Public Engagement”. Towards a Sustainable Energy Economy Workshop, University of Oxford. June 26-28, 2006.
- Pidgeon, Nick. Participant, International Risk Governance Council, conference on Nanotechnology Risk Governance, Zurich, Switzerland. July 6-7, 2006.
- Harthorn, Barbara Herr. “Nanotechnology and Society,” UCSB RISE program. August 1, 2006.
- Bimber, Bruce. “Nanotechnology and Social Movements,” Plenary Address, Societal Impacts of Nanotechnology Conference, Australian National University, Canberra, Australia. Aug 3-4, 2006.
- Rogers-Hayden, T. & Pidgeon, N. “Reflecting upon the First Citizens’ Jury on Nanotechnology, *Nano Jury UK*” Reviewing Humanness: Bodies, Technologies and Spaces, European Association for the Study of Science and Technology (EASST) Conference, University of Lausanne. August 23-26, 2006.

- Rogers-Hayden, T. & Pidgeon, N. "Creating the Future through Public Engagement on Nanotechnologies," Future Matters: Futures Known, Created and Minded, Cardiff University. September 4-6, 2006.
- Harthorn, Barbara Herr, Haldane, Hillary & Bryant, Karl. "Risk and Responsibility: How Nanoscientists and Engineers View the Nano-Enterprise," Society for Social Studies of Science (4S), Vancouver. Nov 2-4, 2006.
- Rogers-Hayden, T. & Pidgeon, N. "Deliberating Emerging Nanotechnologies in the UK and Beyond," Society for Social Studies of Science (4 S), Vancouver. November 2-4, 2006.
- Satterfield, Terre, and Kandlikar, Milind. "Expert Judgments of Public Perceptions: How Well Do They Know their Audience?" Society for Social Studies of Science (4S), Vancouver. Nov 2-4, 2006.
- Harthorn, Barbara. "ICON Project: Global Survey of Industry Safety Handling Practices of Nano Materials," national press presentation teleconference/webcast, Nov 13, 2006, recorded and disseminated by ICON, Rice University
- Bimber, Bruce & Weaver, David A. "Framing Nano in the News," Annual Meeting of Society for Social Studies of Science (4 S), Vancouver. November 2-4, 2006
- Harthorn, Barbara Herr. "NSEC: CNS-UCSB." NSF NSE NSEC PI meeting, Arlington, VA, Dec 4-6, 2006.
- Harthorn, Barbara Herr. "CNS-UCSB Overview," "Working Group 3: Risk Perception and Social Response," "Nanotechnology in Society—Future Directions," NSF Nano in Society PI meeting, Arlington VA, Mar 15-16, 2007.
- Harthorn, Barbara Herr. CNS National Advisory Board meeting, multiple presentations, Apr 23-24, 2007, Santa Barbara, CA
- Harthorn, Barbara Herr. CNS-UCSB NSF External Review, multiple presentations, Apr 25, 2007.
- Harthorn, Barbara Herr. "Nanotechnology, Risk, and Societal Response" NanoRoundtable, Goldman School of Public Policy, UC Berkeley, May 4, 2007.
- Pidgeon, N. "Risk Perception and Communication Related to Nanotechnologies". NNI/RVO/IMEC Nanotech Outreach Workshop, Leuven, Belgium. May 7-8 2007.
- Gibson, R., Lusoli, W., Ward S, and Ackland, R "Mapping "Small Things" on the Web: The Pro- and Antinotech Debate Online," Meeting of the International Communication Association. San Francisco CA, May 24-28, 2007.
- Pidgeon, N. "Risk Perception and Communication Related to Nanotechnologies". European Science Foundation 1st Summer School on Nanomedicine, University of Cardiff. June 10-15, 2007.
- Harthorn, Barbara Herr. "Interdisciplinary Social Science-STEM Graduate Education at the CNS-UCSB," UC DIGSSS/AGEP conf, Santa Barbara, May 25, 2007
- Harthorn, Barbara and Bryant, Karl. "Understanding Nanoscale Scientists' Attenuation Under Uncertainty." Paper presented in "Nanotechnologies: Emerging Risks and Societal Responses" panel at the Society for Risk Analysis-Europe, The Hague, Netherlands, Jun 17-19, 2007
- Rogers-Hayden, T. and Pidgeon, N. Opening up Nanotechnology Dialogue with the Publics: Risk Communication or 'Upstream Engagement'? paper presented in Nanotechnologies: Emerging Risks and Societal Responses, panel at the Society for Risk Analysis-Europe, Building Bridges: Issues for future risk research, The Hague, Netherlands, Jun 17-19 2007.

- Satterfield, T. and Kandlikar, M. “Expert Judgments of Public Perceptions: How Well Do They Know Their Audience?” paper presented in Nanotechnologies: Emerging Risks and Societal Responses, panel at the Society for Risk Analysis-Europe, Building Bridges: Issues for future risk research, The Hague, Netherlands, Jun 17-19 2007.
- Harthorn, BH, “CNS-UCSB: Overview of Research, Education, and Engagement Programs,” presentation in CNS program for incoming summer interns, Jun 25, 2007
- Harthorn, BH, “NanoCafe: Nano-Medicines and Societal Issues,” to be conducted, Santa Barbara, July 18, 2007
- Terre Satterfield, Barbara Herr Harthorn & Milind Kandlikar, “Research and Development in an Age of Upstreaming,” Paper to be presented at the “Studying the Nano-Enterprise” panel for 4S meetings, Montreal, Oct 11-13, 2007
- Tee Rogers-Hayden & Karl Bryant, “Deliberating Nanotechnology Risks: UK and US Perspectives,” Paper to be presented at the “Studying the Nano-Enterprise” panel for 4S meetings, Montreal, Oct 11-13, 2007

D. Panels, symposia, and workshops organized

- Harthorn, B. H. & Rogers-Hayden, T. Co-Chairs/Co-Organizers, “Risk Perceptions and Social Responses to Emerging Nanotechnologies,” session at the Society for Social Studies of Science (4 S), Vancouver. November 2-4, 2006
- Earl, J. and Harthorn, BH Co-Chairs/Co-Organizers, Center for Information Technology and Society and Center for Nanotechnology in Society reception for prospective students, UCSB, Feb 8, 2007.
- Harthorn, B. H. & Bryant, Karl Co-Organizers/Co-Facilitators, Nanotechnology Public Deliberation Workshop, Health and Human Enhancement Technologies, Santa Barbara, Feb 10, 2007.
- Harthorn, B. H. & Bryant, Karl Co-Organizers/Co-Facilitators, Nanotechnology Public Deliberation Workshop, Energy Technologies, Santa Barbara, Feb 11, 2007.
- Harthorn, B.H, Co-Organizer, NSF Nano in Society PIs meeting, Arlington, VA Mar 15-16, 2007
- Harthorn, B. H. & McCray, P. M. Annual Meeting of the CNS National Advisory Board, April 23-24, 2007, Santa Barbara, CA
- Harthorn, B. H. & McCray, P. M. External Site Review, CNS-UCSB, April 24-26, 2007, Santa Barbara, CA
- Pidgeon, N. & Harthorn, B.H. Co-Chairs, Co-Organizers, “Nanotechnologies: Emerging Risks and Societal Responses I and II,” Special symposium at the Society for Risk Analysis-Europe, The Hague, Netherlands, Jun 17-19, 2007
- McCray, W. P. & Harthorn, B.H. Co-Chairs/Co-Organizers, “Studying the Nano-Enterprise,” Panel accepted for 4S meetings, Montreal, Oct 11-13, 2007
- Friedman, Sharon & Harthorn, B.H. Co-Chairs/Co-organizers, panel on “Nanotechnology, Risk, and Social Response” under review for AAAS, Feb 15-19, 2008, Boston

E. Meetings attended

- Harthorn, Barbara Herr attended a standards workshop on nanotechnologies for food and agriculture, organized and hosted by Michigan State University, Sept 2006
- Harthorn, Barbara Herr attended the NISE network annual meetings in San Francisco, Nov 15-17, 2006
- Harthorn, Barbara Herr attended the meeting of the Committee on Anthropology of Science and Technology Studies, American Anthropological Association, Nov, 2006, San Jose
- Harthorn, Barbara Herr attended the NSF NSEC PIs meeting, Arlington, VA Dec 4-6, 2006
- Pidgeon, Nick attended a meeting in London organized by the UK Royal Commission on Environmental Pollution, on nanotechnology risks and the environment. 11 January, 2007
- Harthorn, Barbara Herr attended a conference on Nano Ethics, hosted by the NNCO in Tempe, AZ at ASU. Jan 11-12, 2007
- Rogers-Hayden, Tee attended a meeting in London of the Nanotechnologies Engagement Group (a coordinating group funded by the UK central government Office of Science and Innovation), 26 March 2007.
- Rogers-Hayden, Tee attended a meeting at the Royal Society in London on 'Nanotechnology- Products and Processes for Environmental Benefit, run by the Institute of Nanotechnology, 16 May 2007.
- Pidgeon, N. attended the first meeting of (and is a full member of) the UK Royal Society / Nanotechnology Industries Association working group developing a code of practice for responsible development of nanotechnologies. June 25, 2007.
- Rogers-Hayden, Tee attended a meeting and report launch in London of Demos; NanoDialogues: Four Experiments in Engagement, Institute of Physics, 26 June 2007.
- Rogers-Hayden, Tee attended a meeting and report a launch in London of the Nanotechnologies Engagement Group, Institute of Physics, 26 June 2007.
- Rogers-Hayden, Tee attended a meeting in London of the Science and Democracy Network and Demos: 'A New Social Contract for Science?' Institute of Physics, 26 June 2007.

3. RESEARCH FINDINGS

Risk perception and public deliberation

Data analysis is currently in process for both the expert study and the deliberation research. Some preliminary expected findings (see Research Findings section for more details):

Public deliberation:

1. Significant cross-national differences (US/UK) concerning key variables of interest: Risk; Trust; Equity; Regulation; and Responsibility
2. Significant differences between responses to Energy and Health Nanotechnologies. For the US sample, possible age effects regarding response to Energy vs. Health technologies. Likely greater risk attenuation regarding Energy Nanotechnologies.
3. Response to technologies likely to vary by temporal factors: perceived urgency (Energy) likely linked to lower perceived risk/attenuation; different response to Health applications where deferring judgment (wait and see) mode more likely.

Nanoscientist expert study:

1. Disciplinary differences in perceived technological risk.
2. Nomenclature and definitional issues pervasive, with ‘nanoscience’ a contested domain.
3. Expert attenuation likely; pattern of risk attribution outside one’s own discipline.

Media

1. During 2006, the mean daily number of global English-language news outlets carrying a story addressing at least one societal implication of nanotechnology was 4.7, for a weekly average of over thirty stories.
2. During 2006, five major news events associated with nanotechnology occurred, using the criterion of an increase by more than 2 standard deviations in the daily number of news outlets discussing nanotechnology; these news event ranged widely in topic.
3. News attention to nanotechnology in the U.S. in 2006 was dominated by wire service stories appearing in local television stations and newspapers, and to a lesser extent in big-city newspapers. Original reporting by the *New York Times* and other major papers was sporadic and missed entirely some key news events.
4. Media framing of nanotechnology as a society issue in 2006 remained inchoate. No dominant frames or narrative approaches appear to have emerged yet.
5. Among three general categories of environmental group (focused on toxicity, global processes, and biological issues such as biotech), those in the biological category are most heavily engaged with nano in their web-based discourse.
6. Evidence exists for both the time-in-network version of the preferential-attachment model of web growth and for resource-based preferential attachment among environmental groups.
7. Among the most highly-linked nano-opposition groups is ETC Group, which occupies a highly visible place in web-link networks; despite its web prominence, specific terms of discourse employed by ETC, such as “atomtech,” and “nanotoxicity” do not show signs of diffusion or “contagion” to other allied groups.

Research Integration and Synthesis

The Center integrates efforts among the three working groups and the other Center activities through a number of formal and informal processes.

First, ***within each Working Group*** we combine an interdisciplinary, tiered mentoring approach that incorporates UCSB social science researchers, UCSB nanoscience researchers, collaborators

from other institutions and, in some cases, nations, graduate students from both the social sciences and the nanosciences, undergraduate interns from a range of disciplines, community college interns with diverse backgrounds and cultural experiences, and K-12 teachers, as well as our collaborators in other locales. This structure facilitates mixing of disciplines, tiered mentoring, and the development of common language to discuss the work. The benefits of face-to-face interaction are clear as the work is developing; for those who are not on campus, other methods of contact (audio conferencing, video conferencing, convened meetings, mechanisms for data sharing) are in constant use. The CNS offers graduate students offered opportunities to travel to working group meetings and to make project research presentations, as well as co-authorship of publications and reports.

The *connections across Working Groups* are likewise facilitated by frequent face to face interaction among working group leaders (who all serve on the CNS Executive Committee), frequent communication between leaders with sharing of news, scholarly materials of interest, network opportunities, and research methods, data, and products, and CNS research and meeting space that enhance informal interaction as well. The CNS Graduate Fellows provide crucial cross-Working Group connections too, are working in shared research spaces and take lively interest in connections and differences among the different research areas. The Fellows seminar meets weekly during the academic year, bi-weekly in the summer, and provides vital, regular cross-working group interaction for students and faculty researchers and engagement with outside visitors to the CNS-UCSB. In an attempt to further the integration process, the team leaders are currently initiating a regular informal lunch meeting to ensure sharing of ideas, knowledge, and strategies from the different research streams on an on-going basis.

Spatial analytic and other methods are also being used to integrate data across working groups. As more and larger data sets become available (e.g., through survey research in WG2 and WG3), our capacity to perform this work on a larger scale will be enhanced. Even now, however, we are discovering and developing more and more interconnections among the working groups and collaborators—for example, Tim Lenoir (Duke Univ) began as a collaborator with Working Group 1 (McCray) but is now also working closely with WG2 (Appelbaum, Gereffi), facilitated by his proximity at Duke to WG2 collaborator Gereffi. In another example, WG2 (Newfield) and WG3 (Bimber, Harthorn, Ackland) are currently piloting an experimental collaboration to look together at risk and innovation issues in nano-related organizations. In response to feedback from our Board, the external site team, and our nanoscience collaborators who have more experience in integration of large heterogeneous teams, we have also decided to convene annual meetings at UCSB of all CNS-UCSB collaborators and senior personnel. We are currently scheduling the first of these meetings for Winter, 2008. The last full group meeting was in May 2006 in conjunction with our center launch activities. We expect that these meetings will provide numerous opportunities for integration and synthesis of the CNS-UCSB research efforts.

In addition, we have a number of mechanisms for *CNS-wide integration*, particularly the monthly meetings of the CNS Executive Committee, which includes the research team leaders. It is at this level that joint planning of conferences, future panels, symposia, and publications takes place, and also where synthesis of our network collaboration activities takes place. As research projects mature, we will also be assessing and implementing other mechanisms for synthesis. We have close at hand and readily available to us the highly successful model of the NSF National

Center for Ecological Analysis and Synthesis, and we are currently in discussion with NCEAS about possible future collaborations.

III. Research Findings

At the eighteen-month mark, when this report is written, the research areas within the Working Groups are at various stages of development. Some areas are developing empirical research protocols and procedures, some have completed data collection and are in the process of data analysis, and some are engaged in preparation of research papers, reports, journal articles, and other dissemination materials. Our publication list has grown significantly in the past year, and we project an upward trajectory for publication productivity in the coming year. We are well within or ahead of normal time for research. We report here the key findings to date. These represent a conservative list of empirically supportable findings.

Working Group 1 – Historical Context of Nanotechnologies Major Research Findings

We have identified, via data mapping tools, key institutions for spintronics research as well as publishing and patenting trends for the years 1988-2005. The United States and Japan have been, thus far, the leaders in both publishing and patenting. Within the United States, the majority of spintronics patenting has centered around hard drive-related technologies.

Our work on the history of spintronics has also demonstrated its transitions from a laboratory-based basic science discovery made in European labs to an field funded by DARPA and other military agencies to one which is being supported currently by several university-corporate partnerships. The importance of spintronics, and nanoelectronics in general, in generating community and political support for the National Nanotechnology Initiative c. 1997-2000 was confirmed.

Our research has successfully explored the historical development of molecular beam epitaxy (MBE) as a key proto-nano form of instrumentation. We have also shown how MBE has been important for research in key nanoelectronics areas such as spintronics and quantum dots. Research on quantum dots, like the development of MBE, was spurred by researchers' desire to build and understand novel solid-state semiconductor materials and devices. Continued research on quantum dots, MBE, spintronics, and molecular electronics will further elucidate these relations as well as demonstrate how the current interest in nanoelectronics fits into the existing framework for understanding the history of the semiconductor and magnetic storage device industries.

WG1's research has elucidated nanotechnology's historical roots as well as its ties to other pro-technology advocacy groups in the 1970s and 1980s. This research also suggests a need to move beyond current historical analogies commonly used to understand nanotechnology such as the oft-cited but inaccurate case of GMOs. Our research suggest that the historical development of the U.S. space program or materials science research could offer valuable analogies for policy

makers and scholars to contextualize and understand nanotechnology's roots as well as current context.

Working Group 2: Innovation, Creativity and Globalization

Major Research Findings

Globalization Group

In brief, our research thus far (which is summarized in the paper "Innovation or Imitation? China's Bid to Become a Global Leader in Nanotechnology," currently under review), has chronicled the role of public investment and international collaboration in contributing to China's growing strengths in nano-related R&D and commercialization. China is now spending an amount comparable to the US (when adjusted for purchasing power parity), and its Medium- and Long-Term Plan, along with its most recent Five Year Plans as well as a host of funding sources, all prioritize high-technology development (in which nanotechnology is a priority - one of four designated "science megaprojects" in its Medium- and Long-Term Plan). China's investment in nanotechnology is striking in its emphasis on commercialization. Public support emphasizes "leap-frogging development" to make China a global competitor in the emerging market for nano-enabled goods. While it has a long way to go, much of the data collected and reviewed suggest that China is rapidly closing the gap with the United States and other leading industrial powers in a number of areas (one of which is publication in leading scientific journals, where parity has been reached with the US in terms of output, if not yet in terms of impact). However, there remains disagreement among experts as to the actual standing of China in terms of funding, publication, and patents. Indeed, China's position vis-à-vis other nations is itself an interesting and valuable research question we hope to help address.

A related set of findings, focusing on North Carolina (by our Duke University collaborators), has to do with nanotechnology firms identified by the NC Department of Commerce as being involved in nanoscale research, development and commercialization. We have mapped companies on the nanotechnology value chain by various variables as a first step in identifying NC's footprint in nanotechnology.

Innovation Group

1. Mapping: the nanoscale research enterprise is large and complex but disaggregated. Current attempts to identify clear, linear trends in "nanotechnology" are not readily sustained by the actual state of the evidence.

1a. VOSON Web links: in process

1b. Networks survey: in process

2. Media Study: Public coverage of nanotechnologies is still conceptually rudimentary, and nanotechnologies are not yet identified with a substantive notion of innovation.

3. Group Creativity (terminated): enablers of organizational creativity are phase-specific: for example, an enabling feature of group interaction in early-phase research can become a constrainer in product development.

4. Technology Transfer Policy: most technology managers believe that product incentives will eventually overcome the limitations of the current university-industry interface for nanoscale research, as they believe they have with prior technologies.

Working Group 3 – Risk Perception and Social Response Major Research Findings

Risk perception and public deliberation

Data analysis is currently in process for both the expert study and the deliberation research. Some preliminary findings:

Public deliberation (data analysis phase in process):

1. We anticipate significant cross-national differences (US/UK) concerning key variables of interest in public participation/public deliberation, including perceptions of risk, uncertainty of benefits, concern with issues of equity and social justice, individual responsibility for risk and technology management, views on governance, and the degree to which new nanotechnologies are seen as leading to major social changes and disjunctions. For example, differences in health care systems and access to care in the two countries seem to be associated with different views about who will benefit from nanomedicine developments. There also appear to be possible age effects for the US sample regarding response to Energy versus Health technologies.

2. We also expect significant cross-technology (Energy versus Health) differences. For example, in both countries, there is likely greater risk attenuation regarding Energy Nanotechnologies. Such response to technologies is likely to vary by temporal factors. For example, the perceived urgency that is associated with development of Energy technologies is likely linked to attenuation of risk. On the other hand, we predict that responses to Health applications result in deferral of judgment (a “wait and see” mode).

Nanoscale scientist and engineer expert study (data collection not yet completed; partial data analysis completed):

1. Preliminary data analyses indicate that disciplinary differences among academic nanoscale scientists and engineers will likely be important predictors of perceived technological risk. We hypothesize that gender and rank may also play a role.

2. Nomenclature and definitional issues are pervasive. Our data strongly indicate that ‘nanoscience’ and ‘nanotechnology’ are contested domains for the majority of scientists and engineers we interviewed. These issues are particularly evident in scientists’ and engineers’ assessments of nanoscience/nanotechnology as *new/not new* and *risky/not risky* in both the present and in projected future contexts.

3. There are several different forms of expert risk attenuation in evidence, although the upstream

context and scientific uncertainty of near-term hazards make assessment complex but potentially crucial. Preliminary analysis of academic nanoscale scientist and engineer interviews indicate that there is likely a pattern of risk attribution outside one's own discipline. Preliminary nanotoxicologist interviews indicate likely sharp demarcation from those engaged in basic and applied science and engineering, for instance in views about nanomaterials and risk.

Media

1. During 2006, the mean daily number of global English-language news outlets carrying a story addressing at least one societal implication of nanotechnology was 4.7, for a weekly average of over thirty stories.
2. During 2006, five major news events associated with nanotechnology occurred, using the criterion of an increase by more than 2 standard deviations in the daily number of news outlets discussing nanotechnology; these news event ranged widely in topic.
3. News attention to nanotechnology in the U.S. in 2006 was dominated by wire service stories appearing in local television stations and newspapers, and to a lesser extent in big-city newspapers. Original reporting by the *New York Times* and other major papers was sporadic and missed entirely some key news events.
4. Media framing of nanotechnology as a society issue in 2006 remained inchoate. No dominant frames or narrative approaches appear to have emerged yet.
5. Among three general categories of environmental group (focused on toxicity, global processes, and biological issues such as biotech), those in the biological category are most heavily engaged with nano in their web-based discourse.
6. Evidence exists for both the time-in-network version of the preferential-attachment model of web growth and for resource-based preferential attachment among environmental groups.
7. Among the most highly-linked nano-opposition groups is ETC Group, which occupies a highly visible place in web-link networks; despite its web prominence, specific terms of discourse employed by ETC, such as "atomtech," and "nanotoxicity" do not show signs of diffusion or "contagion" to other allied groups.

IV. Education, Human Resources, and Engagement

CNS-UCSB Education and Public Engagement

April 2006-December 2007

Fiona Goodchild and Meredith Murr

Education

The CNS brings together researchers and students in the social sciences, humanities, engineering, and science to create new, critically-needed collaborative education programs. The

CNS sponsors new undergraduate curriculum, research internships, and community events. Many of these events and activities take place in collaboration with the California NanoSystems Institute (CNSI) whose new facility opened on the UCSB campus in 2006.

The Education program is led by CNS Associate Director Dr. Fiona Goodchild. She has been assisted from January 2006 through May 2007 by Dr. Meredith Murr, CNS Education Coordinator. In June 2007, Education Graduate student Emily Kang, partially replaced Dr. Murr (who is pursuing career advancement opportunities) and is coordinating the CNS undergraduate intern program for the summer, 2007. We anticipate recruiting a new Education Coordinator in Fall 2007.

Student Training Opportunities

The CNS offers opportunities for students – both graduate and undergraduate – to take lead roles in the Center’s research and education initiatives. Graduate student fellows and undergraduate interns work directly with CNS researchers and other faculty at UCSB, and their research seminars are an important part of fostering interdisciplinary collaboration at the Center. The CNS recruits its student fellows from the humanities, social sciences, physical sciences, and engineering.

Graduate Student Fellowships

The Center for Nanotechnology in Society at the University of California, Santa Barbara (CNS-UCSB) has 9-10 fellowship opportunities per year for outstanding graduate students pursuing research in the social sciences and humanities and science and engineering. This is part of CNS-UCSB’s mission to produce and encourage excellent and innovative scholarship that addresses the intersection of nanotechnologies with society.

CNS Graduate Fellows for 2006/2007

Fellow	Department	Affiliation
Karl Bryant	Sociology	WG3
Yiping Cao	Bren School	WG2
Alan Glennon	Geography	WG2&3
Mary Ingram	Sociology	WG1
Gerald S. Macala	Chemistry	WG2&3
Rachel Parker	Sociology	WG2
<i>Name Withheld</i>	Chemistry	WG2
Kim Stoltzfus	Communication	WG2
Joe Summers	Electrical Eng	WG3
David Weaver	Political Sci	WG3

CNS Graduate Student Fellows for 2007-2008

Fellow	Department	Affiliation
Kasim Alimahomed	Communication	WG2
Joe Conti	Sociology	WG3
Scott Ferguson	Mechanical Eng	WG2
Mary Ingram	Sociology	WG1
Erica Lively	Electrical Eng	WG3
Gerald S. Macala	Chemistry	WG2
Tyronne Martin	Chemistry	WG3
Alexis Ostrowski	Chemistry	WG3
Rachel Parker	Sociology	WG2
David Weaver	Political Science	WG3

CNS Undergraduate Summer Internships

The Center for Nanotechnology in Society (CNS) at the University of California Santa Barbara offers summer undergraduate internships for science, engineering, social science, and humanities majors. CNS partners with the INSET program at the California NanoSystems Institute (CNSI) to recruit students from around California to the UC Santa Barbara campus for an 8-week summer research experience. Interns gain first-hand experience in the investigation of the societal issues relating to nanotechnology in a dynamic, collaborative research environment. They are matched individually with nanotechnology, social science, and humanities faculty and graduate student mentors who provide training and support. In addition to research, the interns also participate in weekly group meetings to develop oral presentation skills, attend special seminars and present their results at an end-of-summer poster session.

Summer 2006 CNS Summer Interns

Intern	University	Grad Mentor	PI	WG
William Bausman	UCSB	Mary Ingram	Patrick McCray	1
<i>Name Withheld</i>	UCSB	Kim Stoltzfus	Chris Newfield	2
<i>Name Withheld</i>	Alan Hancock	Rachel Parker	Rich Applebaum	2
Gary Haddow	UCSB	David Weaver	Bruce Bimber	3
Sarah Schultz	Cuesta College	Karl Bryant	Barbara Harthorn	3

Summer 2007 CNS Summer Interns

Intern	University	Grad Mentor	PI	WG
Josie Garong	Oxnard College	Mary Ingram	Patrick McCray	1
Lamar Bush	Santa Barbara CC	Kasim Alimahomed	Chris Newfield	2
Guanglei Zhang	UCSB	Rachel Parker	Rich Appelbaum	2
Jason Cannon	Alan Hancock	David Weaver	Bruce Bimber	3
Nicole Tyler	UCSB	David Weaver	Bruce Bimber	3
Stacy Chirchick	Santa Barbara CC	Joe Conti	Barbara Harthorn	3

Undergraduate Curriculum

Through an award from NSF, entitled INSCITES (INsights on SCience and TEchnology in Society), CNS is collaborating with CNSI to organize a new general education course at UCSB that explores the impact of nanotechnology in society. This involves the direct participation of Evelyn Hu, Patrick McCray, and Fiona Goodchild. The course curriculum modules will be designed and taught by three graduate teaching scholars selected from social sciences, humanities and the science and technology disciplines. The first iteration of the course was offered in Spring 2007. Preliminary evaluation revealed an outstandingly positive response from the undergraduate students. Local community college faculty have expressed strong interest in adapting this course model for their undergraduate students, and we will be working closely with them to implement the transfer. The Associate Director of Education has applied to make a presentation at the annual SACNAS meeting in October 2007 to try to make contact with other institutions with whom we will collaborate in this dissemination.

The CNS Associate Director for Education will explore how the INSCITES program can focus more specifically on nanotechnologies and will consider this aspect as an important factor as we recruit a new set of Graduate Teaching Scholars for the 2007-08 Academic year. We will also consider whether any additional CNS faculty (other than McCray and Hu) would like to contribute to the curriculum design.

In Fall 2007, Professor Harthorn will offer a new upper division undergraduate course, Gender, Science and New Technology, in the Women's Studies program (WS 186 BH) that will include significant attention to nanotechnology. She plans to actively recruit students in the nanoscale sciences and engineering along with social science students and women's studies majors.

Graduate Curriculum

In Fall 2007, Professor McCray, in collaboration with the other CNS faculty, plans to offer a new graduate seminar in History entitled "Studying Emerging (Nano)-Technologies." It will provide systematic background science and technology scholarly education for the CNS Graduate Fellows and other interested graduate students. The course will be designed to accommodate students from the full range of disciplines represented by the CNS Graduate Research Fellows program.

Evaluation

As we move into the second year of the CNS education programs, we recognize the need for integrating various sources of evaluation data. CNS education staff will develop systematic methods to document and collect evidence. With respect to the Graduate Fellows and research interns program, we will administer:

- An initial entry survey to be completed before new Fellows begin the program
- An exit interview and survey for those graduate fellows who are leaving the program in summer 2007

- A data base and regular mechanism to track the subsequent career choices of Graduate Fellows and undergraduate research interns

The data collected in these surveys will be analyzed and reported to the Executive Committee and Advisory Board with a view to assessing how participation in a national center supports or constrains the progress of graduate students towards completion of their Ph.D degree. We will also investigate how interdisciplinary training plays out in terms of future opportunities for research and teaching experience after graduation from UCSB.

CNS will also administer evaluation surveys at events that engage the public so that we can monitor individual responses with a view to improving the design and presentation of such events. We will also keep a record of the demographics of the participants at such events with a view to understanding how the public is interested in the research and related societal issues.

INSCITES

In summer 2007 we will explore how the INSCITES program can focus more specifically on nanotechnology. For example we will consider this as an important factor as we recruit a new set of Graduate Teaching Scholars. We also need to address whether additional CNS faculty would like to contribute to the curriculum design.

Diversity

As indicated above, the CNS recruiting strategies focus on creating a diverse community of graduate and undergraduate scholars, and we have already created connections with professional organizations such as SACNAS. We intend to select the venues for dissemination of the new undergraduate curriculum so that we can create a network of faculty who teach at higher education institutions that serve significant numbers of underrepresented students. We will follow up on contacts provided by Willie Pearson, one of the CNS Advisory Board members, with a view to planning a meeting at Santa Barbara that will focus on the introduction of an undergraduate course on Nanotechnology in Society Spring (2008).

In addition, UCSB recently hosted the national NSF SBES AGEP meeting (May 25, 2007), in which CNS director Harthorn gave an invited presentation on the CNS' unusual program of co-educating science and engineering with social science graduate students. This program appears to be effective in attracting women and minority STEM students who are particularly interested in the kinds of social issues research in the CNS portfolio. The program drew particular praise from the SBES AGEP program leaders and seems likely to become a model for others. The CNS is now directly involved with the NSF-funded UC-DIGSS program to aid UC recruitment of minority students in the social sciences, and we have already contributed to the successful recruitment of a new incoming Latina sociology student in fall 2007 who will work with us in the coming year as a graduate intern, receive summer support to participate in CNS research in summer 08, and will compete for a CNS graduate fellowship as early as Spring 08.

Public Engagement

The CNS-UCSB filled our Communication Coordinator position in January 2007 with the hiring of Valerie Walston. The position began as a .50 FTE and has recently (June 2007) been increased to full-time in response to Advisory Board and NSF site review panel suggestions that we intensify our media and public communication programs to increase the CNS-UCSB profile. Plans for the newly upgraded media program include numerous activities to accomplish this goal.

Speakers Series

In 2006-2007, CNS initiated a Speakers Series that is intended to bring scholars and practitioners to campus to meet with CNS researchers and, as appropriate, give public presentations. In Winter Quarter, 2007, this has included visits by: Stanford nanotechnology ethics researcher, Robert McGinn, ASU's Jamey Wetmore to present his work on nanotechnology and religion, NNIN's Angela Berenstein to talk about UCSB's role in the National Nanotechnology Infrastructure Network, and Oren Livne, Associate Director for Licensing in the UCSB office of Technology Transfer to discuss nanotechnology licensing in the University of California. In Spring Quarter, 2007, leading EU nanotechnology and society expert Professor Arie Rip (Twente University, the Netherlands) visited for several days, giving a standing room only public talk and an in-house CNS fellows' seminar. We plan to have 1-4 speakers per academic quarter, and to host at least 1 public event per quarter.

NanoCafé

In 2007 CNS and CNSI have jointly initiated an informal nanoscale science discussion forum, the NanoCafé. Modeled on successful public engagement efforts at our Nanotechnology in Society network partner, University of Wisconsin at Madison, this first session in April immediately drew a large (35+) public audience, and stimulated a lively discussion among researchers and the public. The next NanoCafe will take place in July at a downtown venue in Santa Barbara according to a plan for a one time per quarter event, with joint facilitation by CNS and CNSI principals, and joint staffing from both entities.

Conferences

A major national conference on Occupational Health and Safety in Nanotechnology is planned for November 15-17, 2007 at UCSB. The conference is the result of collaborative planning, co-sponsorship and co-funding from Nano in Society network partners, Harvard University (Richard Freeman) and UCLA (John Froines, Lynn Zucker, Andre Nel). CNS-UCSB principals Rich Appelbaum and Barbara Herr Harthorn are the co-hosts of the conference.

As mentioned below (under Diversity) we plan to host a conference on undergraduate education in Spring 2008 to discuss the translation of the INSCITES course modules to colleges and universities, with a particular emphasis on institutions that serve a significant population of underrepresented students.

CNS-UCSB Weekly Clips

This feature tracks and circulates electronically a list of major breaking news stories on nanotechnology and societal issues. We disseminate to a growing list of interested colleagues, students, government and policy people, industry contacts, nongovernmental organizations, and

members of the general public. Beginning in Summer 2007, we will be distributing an electronic Quarterly Newsletter of the CNS-UCSB's own activities to a similar variety of CNS constituents.

Public presentations

CNS researchers and graduate students also make frequent public presentations to campus, local, regional, and wider audiences about the work of the CNS-UCSB. Since July 1, 2006, examples of these include: the EMSEM (Expanding Pathways to Science, Engineering, and Mathematics) Summer Institute (McCray), the RISE (Research Internships in Science and Engineering) program through the UCSB MRL (Harthorn), the ICON project roll out national press conference (Harthorn), the Goleta Valley Chamber of Commerce (Grad Fellow Macala), and numerous others (see Appendix B for complete list).

Web site and Clearinghouse

Through the CNS-UCSB *Clearinghouse*, we aim to share the tools and resources generated for our own research, education, and public outreach programs to a wider audience. Such resources will include: identification and links to other researchers and their interests; sharing of emergent publications and bibliographies in annotated and/or classified format; clipping service re: public media coverage; all CNS reports and products; and educational resources from UCSB and elsewhere, with necessary permissions, such as syllabi of nano-society courses. The CNS Web site (cns.ucsb.edu) was mounted in late Fall 2005 in anticipation of the January 2006 start date and serves as the main portal for information dissemination to and contact with the various constituencies the CNS aims to serve. Web design and implementation was been an ongoing priority in year 1, and we are now moving into processes for continual updating, redesigning as necessary to meet the changing needs of the CNS-UCSB, and to take advantage of new capacities for internal and external communication, data storage and access, and learning tools support.

The Web site is mounted on our host server in the UCSB Institute for Social, Behavioral, and Economic Research (ISBER), which provides a secure and stable backbone for maintenance of our system. Computer and network support from ISBER have enabled us to seamlessly incorporate new functionalities and information so far, and we have achieved significant economies and efficiencies through this partnership. As data collection increases and collaborations become more extensive around the globe, the need will increase for the CNS to serve as a "collaboratory." We will continue to review and modify the formats, functionalities and capacities of the website to meet its Clearinghouse mandates. In the future we anticipate the CNS-UCSB website will become a site for public interaction about nano and society issues, through such methods as participatory mapping, opinion collecting, and dialogue.

Plans for Engagement with Nanoscientists and Engineers Year 2--2007

Engagement with nanoscientists and engineers is a central and distinctive aim of the CNS-UCSB. To that end, we have the following plans for fulfilling this mission.

Executive Committee

We include active direct participation in the management of the CNS-UCSB by members of the nanoscience community at UCSB. The Executive Committee of the CNS-UCSB is the main decision making body of the Center in matters of research direction, education, and outreach. All seven members are full participants in now monthly (previously more frequent) meetings and numerous e-mails and direct consultation between meetings. All members fully participate in discussion, planning, assessing and reporting on the CNS activities. Two of the seven members are from the nanoscience community – Evelyn Hu, our Associate Director for Nanoscience, is a physicist and member of Electrical Engineering and Materials departments, as well as Director of the California NanoSystems Institute (CNSI) at UCSB, and Fiona Goodchild, our Associate Director for Education, is a science education and outreach expert and Director of Education at the CNSI. Both bring far reaching connections and insight into the campus, regional, and national nanoscience communities, and their involvement in our decision making ensures both that we account for their interests in our plan making and that they understand the rationales and actions of this social science center.

National Advisory Board (NAB)

The NAB is designed to serve both as a sounding board and an informal evaluation role for the CNS as it develops over the 5 years of funding. As such, it was designed to draw from the major communities for engagement of the CNS, and nanoscientist involvement in the board has been essential. The NAB of the CNS-UCSB is currently chaired by Tom Kalil, Science Policy Advisor to the UC Berkeley Chancellor, and leader of UCB nanoscience development initiatives. In addition, the NAB includes: Rice University nanochemist and national center (CBEN) leader, Vicki Colvin, Harvard nanoscientist and NSEC director, Robert Westervelt, and Martin Moskovits, a leading nanoscience chemist who is former Dean of Mathematical, Physical and Life Sciences at UCSB and currently working in industry with API Nanotronics. In addition to Kalil, the CNS Board also has another leading science policy advisor, engineer Susan Hackwood, Director of the California Council on Science and Technology Policy. Thus almost half of the 11-member board is made up of science and science policy advisors.

Location and Spatial Proximity

The CNSI has provided the CNS-UCSB with 3 ocean view offices in its newly opening building on campus. Our education program is now physically based in the new building, adjacent to the CNSI's very active education and outreach team, so we will be engaging with them on a day-to-day basis. CNS-UCSB Director Harthorn maintains a shared research office in the CNSI to facilitate daily interaction between CNS personnel and CNSI personnel at the highest level. The CNSI also provides formal and informal meeting contexts for CNS and CNSI researchers, students, and staff, e.g., conferencing space, access to the Allosphere (a new multi-story 3-D lab for visualization of scientific data, run by the discipline-spanning Media Arts and Technology Program), a café, informal lounges, and spaces for public engagement as well. Our first NanoCafé was held in the lobby of the CNSI in April 2007.

Research Program

All three Working Groups (WGs) of the CNS involve plans for fine grained social science research with nanoscientists and engineers, both at UCSB and elsewhere. In addition to Evelyn Hu's commitment of CNSI involvement with the CNS-UCSB, WG 2 and WG 3 have established collaborations with and commitments for involvement from a number of leading nanoscale

scientists and engineers (WG2: Daniel Blumenthal, Tim Cheng, Brad Chmelka, Glenn Fredrickson, Arthur Gossard; WG3: Kevin Almeroth, David Awschalom, Elisabeth Gwinn). We are in regular communication as well with a number of other leading campus nanoscale researchers (e.g., Craig Hawker, Director, Materials Research Lab and MRSEC). We are drawing top science graduate students as applicants to our Research Fellows program. They come with the endorsement of their advisors, strong evidence of the estimation of the CNS by our colleagues in science and engineering fields.

More specifically, WG 1 is engaged in depth interviewing of UCSB and extramural scientists involved in the development of spintronics research, as well as oral histories with several leading campus researchers. A number of interviews have already been completed, and more are in planning. The willingness of researchers to commit to this interview process is one index of engagement with the CNS. In addition WG 1 is mapping the networks and historical interconnections among nanoscience spintronics researchers, and leader McCray has been invited to participate at an international meeting of spintronics researchers.

WG 2 has two main projects, the first looking at innovation processes, the second at globalization. The innovation studies have involved a number of face to face research planning meetings with the collaborators, and will in years 1 and 2 involved systematic interviewing of nanoscientists and their students and postdoctoral students across different kinds of laboratory and institutional settings. The globalization research has similarly involved extensive planning meetings, interviewing of China and US nanoscientists at an NSF meeting, and interviewing of UCSB, Duke, and East Asian nanoscientists. The team plans its second set of research trips to China and Taiwan in July and August 2007.

WG 3 has two projects that involve nanoscientist participation. The project on risk perception is interviewing samples of California and West Coast academic nanoscientists, nanotoxicologists, and regulators about nanotechnologies' risks and benefits. This work began in July 2006 and will be completed in summer 2007. It provides a necessary prelude to surveying and depth interviewing of the public about their risk perceptions. In addition, the public participation research team has completed data collection for a comparative US-UK study of public deliberation workshops that drew on UCSB nanoscience expertise for helping create and validating the technical material on nanotechnologies presented in the workshops.

In all cases, the nanoscience community at UCSB and elsewhere has been receptive to our working with them on this research, has made significant commitments of their time, their students, and their knowledge in support of our work.

Education Program

Our recruitment and summer internship programs are closely coordinated with the CNSI's, providing a strong, deep interconnection between our two programs, and direct links as well to a number of other acclaimed science education and outreach programs on campus that involve nanoscientists and engineers, for example through the NNIN, of which UCSB is a member, through the MRSEC housed in the Materials Research Laboratory (MRL), the Let's Explore Physical Science (LEAPS) program, among numerous others.

More directly, and as a result of extensive consultation with campus nanoscientists, the CNS has a program of CNS Science and Engineering (S&E) Graduate Research Fellowships that involves at least 4 science and engineering graduate students (5 in 07-08) directly in CNS Working Group research programs each year, working alongside and in close contact with CNS Social Science Graduate Research Fellows and faculty researchers. The S&E students participate in the weekly fellows meetings, working group meetings, and are taking an active role in the research. There is already evidence that through their students, faculty scientists are gaining insight into our work, appreciation for our social scientific methods, and enhanced interest in engaging with us.

CNS is also involved with CNSI in the innovative education program that gives the opportunity for graduate students in the science, engineering, and the social sciences to formulate a course for undergraduates that integrate 'real nanoscience' (including labs) with historical and social context. INSCITES (Insights on Science and Technology for Society) funding is provided through an NSF Distinguished Teaching Scholar award to CNSI Director and CNS Co-PI Evelyn Hu. CNS Co-PI Patrick McCray has been co-teaching the INSCITES course, and others in the CNS will be increasingly involved in the coming year.

Campus outreach and programming

CNS and CNSI are partnering on a number of fronts, most evidently in our NanoCafé, and informal public discussion event, co-led by CNSI and CNS researchers. Discussion is underway for future conferencing and other

New collaborations between CNS and nanoscientists and engineers

In 2006-07, the CNS-UCSB received co-funding for a collaborative research project with a nanotoxicologist (microbiologist Patricia Holden, Bren School for Environmental Science and Management) that resulted in a nationally visible report, now in preparation as a publication on nanomaterials safe handling. We have submitted two other significant proposals in the past year in partnership with nanoscale science and engineering research and education initiatives (both unsuccessful thus far). More intersections of funding effort are under discussion on the research, education, public outreach, and media program and communication fronts, and CNS leaders are committing significant time and effort in this direction on a regular basis. In addition, CNS Director Harthorn has been approached to participate in emerging discussions with campus EH&S personnel about campus implementation of nanomaterials safe handling guidelines.

Nanotechnology in Society Network Activities

Since the formal start of CNS-UCSB, we have engaged the other national center at ASU and other nano-projects in a number of different ways. Face to face meetings are very important, although they are not a part of our NSF budget. So far, we conducted a preliminary meeting at UCSB with ASU principals Dave Guston and Dan Sarewitz in Nov, 2005 to discuss shared national center duties. We also participated as a team (Harthorn, McCray, Appelbaum, and Newfield) in a day-long network meeting held February 8, 2006 at the National Science Foundation and two-day meeting in March, 2007 also at the NSF (see below).

Harthorn also regularly participates as CNS-UCSB PI in Nanotechnology in Society Network (NSN) conference calls on the first Wednesday of each month, initiated since the February

network meeting. The other participants typically include the Principal Investigators from each of the network groups, Dave Guston (CNS-ASU), Davis Baird (USC), and Richard Freeman (Harvard/UCLA). To date, discussions have focused primarily on strategic topics such as clearinghouse issues, joint conference planning and calendaring, as well as how to best leverage the research and education efforts of the other groups in the NSN. Collaborative research and education conferences are currently advancing in discussion, and this conference call mechanism is providing a useful method for informing one another about activities. In addition, Harthorn and Guston exchange frequent communication in their roles as PIs of the two NSEC:CNS entities, and this has been very helpful. Harthorn was an invited guest at the January launch of the CNS-ASU, and ASU sent an invited guest to the May launch of the CNS-UCSB.

National and International Network Activities

Since the formal start of the CNS-UCSB, we have engaged the other national center at ASU and other nano in society projects in a number of different ways. This has included 2 annual meetings among project leaders, the 1st for 1 day on February 8, 2006 and the 2nd on March 15-16, 2007, both at the National Science Foundation. For the 2nd of these, CNS-UCSB has provided the infrastructure support by applying for a supplement to our primary award and handling all travel reimbursements for the more than 30 participants.

Director Harthorn also regularly participates in “nano and society” network PI conference calls which have been occurring generally on the first Wednesday of each month since March 2006. Participants usually include Dave Guston (CNS-ASU), Davis Baird (USC), and Richard Freeman or Lynne Zucker (Harvard/UCLA). The Principal Investigators from each of these groups discuss strategic topics such as clearinghouse issues, joint conference planning and calendaring, as well as how to best leverage the research and education efforts of the other groups in the “nano and society” network. In addition, as PIs of the two NSEC: CNS awards Guston and Harthorn communicate regularly by phone and e-mail about center management, administration, research, and education issues.

Representatives of the CNS-UCSB also have attended meetings of the International Nanotechnology and Society Network: in London, in March 2006 (Newfield, Rogers-Hayden) in Oxford, and in November 2006 (Harthorn, Pidgeon, Satterfield, and Rogers-Hayden) in Vancouver in conjunction with the 4S (Society for the Social Study of Science) meetings.

A number of conversations, collaborative activities and joint ventures have emerged from these network meetings. A non-exhaustive list includes:

- CNS-UCSB has agreed to serve as a 6th site for the ASU-based National Consensus Workshops planned for March 2008 (funding pending)
- WG2 research Newfield has been in frequent discussion with ASU’s partner, Phil Shapira at Georgia Tech on substantive bibliometric matters
- Co-Director McCray has joined the Advisory Board for Univ. of S. Carolina’s Nano research center
- Director Harthorn has organized 3 nano risk panels at national and international conferences (4S 2006, Vancouver; SRA-E 2007, The Hague; AAAS 2008, Boston--

- pending) that have included or been co-organized with Harvard/UCLA partner Sharon Friedman, Lehigh University
- MSU's NIRT leader Larry Busch is networking with WG2 Rich Appelbaum to develop contacts for research in China
 - A group of people who attended the MSU nano food and agriculture workshop in Sept 2006 are communicating regularly about nano regulatory issues
 - CNS-ASU and CNS-UCSB are discussing partnering a conf w/ the NISE network to bring the research and informal science education communities closer together
 - CNS-UCSB is the lead site for a conference on occupational health and safety, developed from initial plans by Harvard's Richard Freeman and WG2's Rich Appelbaum
 - Traveling of visitors across the network sites—students, visiting scholars, collaborators—is increasing over time

V. Contributions

The CNS-UCSB is situated at the nexus of all four of the University of California at Santa Barbara's main strengths identified in its long range plan: international and global studies; new technology; environment; and our renowned capacity for interdisciplinarity. In terms of its broader vision, the CNS seeks to update the organizations that have produced many of the intellectual breakthroughs that have been most valuable to society. The modern research university arose to serve both economic and human development and is now a hybrid and multivalent network of semi-autonomous units that struggles to adapt to the changing requirements of discovery and dissemination. With this history in mind, the CNS recognizes that its research, education, and outreach efforts will prompt continued structural redesign. The CNS aims to create a genuine learning community of diverse participants that can pool its knowledge for the simultaneous benefit of society and technology. In so doing, the CNS may serve as a model for reconfiguring knowledge institutions to remain timely, accurate, and relevant in a period of rapid change.

The research mission of the CNS – to provide a systems-level analysis of nanoscale research and development, the global diffusion of nanotechnologies, and responses to nanotechnologies as they emerge – is an ambitious multi-year plan. Because nanotechnology spans such an enormous range of possible applications and implications, it will not be sufficient simply to mount a series of independent projects studying one or another technology in isolation. It is clear that the entirety of the nano-enterprise must be kept in view, so that funding decisions, policies, and regulations do not advance piecemeal. This poses a research challenge that is largely unprecedented. Compared with the decisions associated with the advance of information technology, for instance, nanotechnology presents a qualitatively larger and more complex challenge, and the upstream context adds yet additional complications. Traditionally, scholars studying science and technology have been successful at examining one or two areas of impact; those studying nanotechnology must simultaneously confront a broad range of implications and, ideally, integrate and combine their research findings into results that inform other scholars, policy makers, and the various public communities the CNS serves.

The CNS has the potential to make significant contributions to and between the primary academic disciplines involved with it as well as to education and human resource development. For example:

- The ephemeral nature of materials to document and understand the nano-enterprise poses a challenge to historians other STS scholars. The tools and methodologies developed and used by CNS researchers may provide an example for documenting the development of other contemporary emerging technologies that, like nanotechnology, will be important in the 21st century.
- WG2's research on the innovation and diffusion of technology in multiple contexts – from the individual laboratory to the academic-corporate nexus to the global setting – will combine contributions from the social science and humanities to better understand how new technologies are created and transmitted. The international and global scope of CNS-UCSB's research focus and its international collaborations in pursuit of that focus provide a powerful dual strength.
- WG3 is poised to contribute to both the scholarly and practical understanding of emergent risk through collection of vital baseline data about different communities' risk perceptions, technological values, and beliefs, tracking of ongoing media framing (and reframing) of these new emerging technologies, and following unfolding social response at the level both of the individual and of collective action.
- The CNS is fundamentally an interdisciplinary undertaking. The CNS employs a set of integrative activities that help synthesize the WGs and involve its non-academic collaborators. Most simply and practically, the WGs share research results on an ongoing basis through regular meetings, seminars, and consultations within the Center. The CNS will combine depth with integration by allowing each WG to pursue its research independently, while providing mechanisms for continuously synthesizing research results and sharing educational, outreach, and collaborative activities. New mechanisms are being employed to ensure continuity in the vital processes of intellectual and knowledge synthesis.
- The social science research of the CNS will be done in close collaboration with members of the engineering and science communities at UCSB and elsewhere. The information and research generated by the CNS, as well as the interactive process through which this takes place, will enable the science and engineering communities to better understand the social, economic, political, and cultural contexts of their research.
- The CNS's education and engagement programs will be leveraged with other education programs at UCSB including those of the California NanoSystems Institute. Innovative new courses and programs such as INSCITES will offer students the opportunity to gain a more comprehensive understanding of key technologies in the societal contexts. In addition, to date 30 graduate and undergraduate students have been given the opportunity to participate in CNS research through its Graduate

Research Fellowship and Summer Internship programs. Students involved are drawn from a wide range of disciplinary backgrounds and life experiences and are enabled to learn new epistemologies and methodologies through working in an interdisciplinary, collaborative context between traditional academic boundaries. CNS educational outreach builds on a strong set of institutional ties with regional California community colleges that serve Latina/o students, an AGEP program with Jackson State University, the NSF-funded UC-DIGSSS program to enhance recruitment of talented underrepresented social science graduate students, and award winning K-12 programs.

- In its research, education, and outreach efforts, the CNS has worked to engage a diverse range of public communities with attention to diversity of ethnicity, gender, and experience. This has been especially successful thus far in the recruitment of student research fellows and interns

The CNS also has the capacity to engage and inform policymakers and governmental agencies involved in the development of public engagement and public participation programs (for example, the NNCO), to serve as both a forum and a moderator/facilitator in discussion and debate among diverse nanoscience experts and publics, and to serve as a resource base to the public policy and research communities. We have purposely included a number of public policy experts on science and technology policy on our National Advisory Board, and we will draw on their expertise in developing this part of our program.

VI. Management and Governance

A. Management

Management of the CNS-UCSB occurs at three interrelated levels; the organization chart below illustrates the Center's management and organizational structure. The CNS is led by Principal Investigator, Barbara Herr Harthorn. Dr. Harthorn is responsible for all official agency contact with the CNS-UCSB, for adherence to campus and agency policies regarding fiscal controls, IRB, and the oversight of all CNS business. She is the primary contact for the CNS to the UCSB upper administration and the CNS' administrative unit, the Institute for Social, Behavioral, and Economic Research. In these capacities, she is responsible for oversight of fiscal management, campus matching funds, CNS subcontractors, space allocation, and compliance with UC and UCSB campus policies. As PI, Dr. Harthorn also represents the CNS in NSF Nanotechnology in Society Network and NSEC interaction.

CNS co-directors Barbara Herr Harthorn and Patrick McCray have jointly overseen the day-to-day operation of the Center in conjunction with full and part-time CNS staff members and the CNS Executive Committee. The Co-Directors have frequently been called upon to represent the CNS in presentations to campus, local community, national and international academic and activist communities, and in interaction with the press. Having two Co-Directors has been of enormous value to the CNS-UCSB in its first 18 months of operation (and the exceedingly demanding 6 months prior to the start date). However, now that the Center is fully up and running, staff recruitments are completed, and the first external site review is successfully

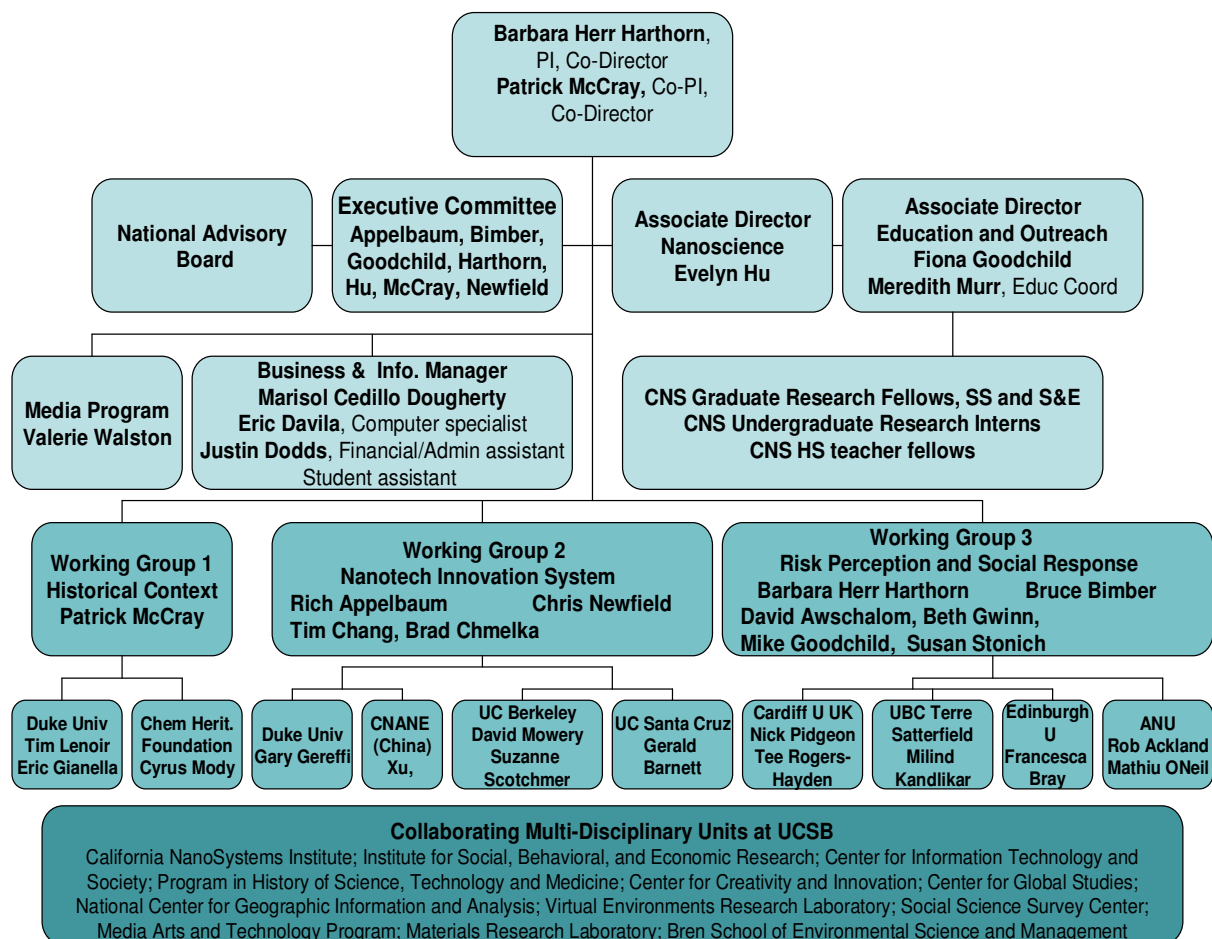
concluded, the Executive Committee of the CNS has agreed with the Co-Directors that one Director will be adequate to meet the on-going leadership needs of the CNS, given the very active, engaged, and proximate Executive Committee. Therefore, as of July 1, 2007, Co-Director Patrick McCray will step down, and Co-Director Harthorn will assume the sole Directorship of the CNS. Dr. McCray will continue full participation as Co-PI, Executive Committee member, and as the leader of Working Group 1. The UCSB campus administration has signed off on this change.

The CNS Executive Committee meets on a regular basis and addresses longer-term strategic planning for the Center in consultation with the Director(s). The membership of the Executive Committee is the Director(s), the leaders/co-leaders of the 3 working groups, and the Associate Director for Education, and the Associate Director for Nanoscience—who is the Director of CNS' partner organization, the California NanoSystems Institute. Executive Committee members include: Richard Appelbaum, Bruce Bimber, Fiona Goodchild, Evelyn Hu, Barbara Herr Harthorn, Patrick McCray, and Christopher Newfield. Executive Committee meetings cover all issues of CNS operation, including staffing, budget, research activities, collaborations, education initiatives and personnel, internal and public events and programs, network activities, website monitoring, agency oversight and reporting activities, annual board meetings, and other matters as they arise. Meetings occur on a monthly basis, with more frequent intervals during times of intensive work preparation; any members who are not physically present are dialed in by conference phone. Electronic correspondence within the Executive Committee takes place on a near-daily basis. Meeting agendas and supporting documents are on file in the CNS administration. CNS staff participate in all Executive Committee meetings as well. Additional meetings, for example among the working group leaders, take place as needed to address particular research issues that arise. Regular weekly or bi-weekly lunch meetings of the research leaders are being implemented in July 2007.

NSF resources are being leveraged well with existing university support and administrative services. CNS staff draws regularly on the expertise of the staff of our control point, the Institute for Social, Behavioral, and Economic Research, for assistance in all aspects of extramural award administration, accounts management, personnel action, travel accounting, purchasing, and computer network administration. The close working relationship with ISBER has enabled CNS to move quickly and efficiently in a number of areas, and the capable ISBER staff provides backup to CNS' smaller, more specialized staff. In addition, the CNS is achieving savings through the sharing of computer technology staffing with ISBER and others of its research centers. This gives the CNS access to versatile skills when needed, without having to commit full-time salary expenditures.

The main shortfall in CNS infrastructure at this time is the absence of an advanced lead staff person to assist the Director(s). Both the CNS Board and the External Site Review panel endorsed the need for more support, and a request is currently pending with the NSF to see if they would entertain a supplement to the Years 3-5 CNS-UCSB budgets for this purpose and to augment other partially funded staff positions.

CNS-UCSB Organizational Structure - April 2007



Year Two Management Activities

In summer 2006, we hired a .25 FTE computer and network technician whom we share with our host Organized Research Unit, the Institute for Social, Behavioral, and Economic Research- ISBER. Eric Davila has been providing desktop support and programming services to CNS since his hire in July 2006. Given the difficulty of recruitment of highly skilled computer network technicians for part-time positions and the absence of anyone within the CNS to supervise such personnel, sharing this position with ISBER and the Social Science Survey Center in ISBER has been a cost effective and practical solution to our CNS computing needs.

In Jan 2006, we hired a new staff person, Valerie Walston, to serve as the Communication Coordinator for the CNS. In its initial configuration, this was a split position with the CNSI. After the initial 3 months of experimenting with this arrangement, the CNSI and we agreed that the position would work more effectively as a full-time position in one of the two units. Our April Board meeting and NSF External Site Review both identified media outreach as an urgently needed gap in our effort, so the CNS has moved Valerie, a highly experienced public

information officer, into full-time employment for us. In addition to media outreach tasks, the position in its full-time configuration is also intended to provide CNS events coordination and Web site updating for us. This is probationary for another 3 months, at which time we will assess this arrangement and performance. Both Board and site team exhorted us to increase our core staffing to help defray Director(s) work overload, and expanding this position is a vital first step.

The CNS web page (cns.ucns.edu) has been continually updated with news items as well as material describing the activities of the Center, and Co-Director McCray has maintained major oversight over this process. As the new Communication Coordinator position settles in, we anticipate that CNS staff can absorb and carry out some of the needed updating while communicating with the necessary CNS staff, researchers, and students about needed materials. In addition, the Clearinghouse functions are being augmented as the media component develops significant resources to share with the public (e.g., the CNS-UCSB Weekly Clips). Research materials will be mounted to the site as they are completed.

CNS-UCSB co-hosted with the NSF the Nano in Society PIs meeting in Arlington, Mar 15-16, 2007. This entailed submission of a supplement request by PI Harthorn for the funds to hold the meeting, coordination with NSF staff for the hosting of the event, and reimbursement by CNS staff of all travel expenses for the more than 30 attendees of the meeting. These funds are included in the budget reported for our Year 2.

Communication

Clear and regular communication is essential to the management of any organization. To achieve this end, CNS-UCSB researchers and staff are in regular communication with one another. Members of the executive committee meet on a regular basis and those not physically present join via conference call. Email provides another forum for the exchange of ideas and information. Finally, the CNS website is continuing development to increase the means for more complex databases to be created, stored, and shared internally with adequate security maintenance and externally when desired and appropriate. We have been successfully using secure sites on the ISBER server for sharing data and resources with collaborators around the world.

National Advisory Board

A crucial part of the CNS' plan for engagement with different constituencies and for evaluation of its efforts by them involves the creation and involvement of a National Advisory Board. The purpose of the board is to meet annually, to review all aspects of the CNS-UCSB operation, and to provide suggestions and advice about our work, our approach to the work, recommended changes in approach, and planning for the post-initial-funding period of the CNS-UCSB. Senior SBE Directorate officials are invited to attend NAB meetings as observers and, at the invitation of the board, as participants. The Chair of the NAB coordinates the provision of a verbal report summarizing the Board's actions at the conclusion of each year's meeting.

The Board's members meet annually and are all national leaders in policy, research, and/or industry. Membership of the Board as of June 2007 is:

- Thomas Kalil, UC Berkeley and former Deputy Assistant to the White House for Technology and Economic Policy, Board Chair 2007-2009
- Ann Bostrom, Associate Professor in School of Public Policy at Georgia Tech [moving to University of Washington, Seattle, as of Sept 2007]
- John Seely Brown, Visiting Professor at University of Southern California and former Chief Scientist of Xerox Corporation and the director of its Palo Alto Research Center (PARC)
- Craig Calhoun, President of the Social Sciences Research Council and University Professor of the Social Sciences at New York University
- Vicki Colvin, Professor of Chemistry and Executive Director of the Center for Biological and Environmental Nanotechnology at Rice University
- Ruth Schwartz Cowan, Professor in the History and Sociology of Science Department at the University of Pennsylvania
- Susan Hackwood, Executive Director of the California Council on Science and Technology
- Julia Moore, Deputy Director of Foresight and Governance Project at the Woodrow Wilson International Center for Scholars
- Martin Moskovits, AIP Nanotronics (former Dean of Science and on leave Professor of Physical Chemistry, UCSB)
- Willie Pearson, Jr., Chair of History, Technology and Society at Georgia Tech
- Robert Westervelt, Director of the Nanoscale Science and Engineering Center-NSEC at Harvard University

The 2nd annual meeting of the NAB was held in Santa Barbara on April 23-24, 2007, immediately preceding the CNS's first external site review (April 24-26, 2007). The meeting was attended by Board Chair, Kalil, and members Seely Brown, Colvin, Cowan, Hackwood, Moore, Moskovits, and Pearson. Member Calhoun had to decline at the last minute because of urgent SSRC business in New York. NSF Program Officers Priscilla Regan and Rita Teutonico from SBE also attended the entire meeting. The board was highly enthusiastic about the extent and quality of the work completed by the CNS-UCSB and offered a number of specific means to assist us in the coming year. The only significant cautionary concerns were work overload for Director Harthorn and the need for a significantly enhanced media program to better publicize the excellent work we are doing. Both of these concerns are being addressed.

B. Evaluation plan for CNS-UCSB

The evaluation plan for the CNS-UCSB is to evaluate performance against our goals in the main functional areas--research, education and public outreach, network with other nanotechnology in society programs, international collaboration, and clearinghouse.

More specifically, we continue the following plans for evaluating the CNS and its work against the goals we have set. The goals are laid out in the original proposal, as modified by the revised statement of work submitted in August 2005. We will evaluate work formatively and summatively at several levels of aggregation: within each working group on a regular (monthly to quarterly basis), at the steering committee level also on a quarterly basis, and at the level of the National Advisory Board on an annual basis.

Seek continuous feedback

We begin with efforts to solicit and incorporate continuous feedback. This type of formative evaluation involves a continual quest for information about all areas of our functioning. In the research working groups, the mechanism for this is monthly quarterly? Progress reports by the working group project leaders that are circulated to the full CNS executive committee. Monthly face-to-face meetings of the Executive Committee have already proven invaluable for appraising progress toward goals. Additional meetings among working group personnel are also ongoing, both to coordinate research within groups and to integrate efforts between groups. The education and outreach program is also providing monthly updates, meeting weekly with all graduate fellows, and will be providing extensive programmatic support to undergraduate interns. (See Education and Outreach Program section for specific education program evaluation methods and goals.)

The CNS Executive Committee is the main formal mechanism through which such formative evaluation takes place, with on-going discussion of possible problems, necessary adjustments to plans or activities, and communication. The meetings are largely face to face (although traveling members may be on conference call) and take place on a monthly or more frequent basis. The Director(s) maintain oversight of this process. The National Advisory Board (NAB) members are available for consultation on an as needed basis as well, and we confer with them when additional advice is needed. There is a high level of intercommunication among the principals of the CNS, and a very significant circulation of scholarly and practical advice, references, articles, and other knowledge sources among the Executive Committee members, staff, and students, primarily by electronic media. We are using on-line methods to facilitate this process, and we will be conducting ongoing analysis of their effectiveness.

The CNS staff members are involved in the monthly Executive Committee meetings and managed on a day-to-day basis by the Director(s). Education program staff is supervised by the Associate Director of Education. Staff are being provided with extensive assistance and managerial oversight by the experienced and knowledgeable professional staff of the Institute for Social, Behavioral, and Economic Research (and, in the case of the Education Coordinator, the CNSI), with whom they occupy adjacent space. Regular work performance evaluation is mandated for all as UCSB employees.

Budgetary controls within the University of California are very rigorous, and budget oversight of the CNS is maintained by ISBER and the Office of Research. The CNS manager and director(s) are in near daily consultation about budget matters, and, as needed, with all personnel, subcontractors, and service providers.

Quarterly reporting is required from all CNS research teams, UCSB and extramural subcontractors. This is a requirement in conjunction with invoicing for subcontractor payments, and these documents are circulated to all CNS principals. The Education program also reports quarterly on accomplishments and any issues of concern. These written records provide detail that our face-to-face meetings cannot cover, and serve to inform everyone about ongoing work of the CNS.

Achieve aims

This kind of summative evaluation takes place primarily on an annual basis. The main mechanisms for achieving this are: annual reporting (for the CNS and for the NSF) and annual meetings with the NAB. Annual reporting will be required for all components of the CNS, and such cumulative records will be the subject of focused meeting and discussion. The NAB, in addition, will meet annually in Santa Barbara and will be requested to provide detailed commentary, advice, and criticism both in person and in a written report. A key part of the NAB process will be an executive session without CNS leadership, aimed at producing candid discussion and appraisal by this distinguished body of people outside CNS but familiar with us. NSF visitors will be invited to attend these meetings as observers, and, if the NAB is willing, will be free to provide commentary.

NSF annual reviews provide an opportunity for summative evaluation. Annual retreats of the CNS Executive Committee and staff are planned, following the NSF site review process. In 2007, the CNS held a day-long retreat on May 18 to discuss the external site review panel's comments and the Board suggestions in view of needed changes.

Additional summative measures are drawn at any natural junctures, for example, the completion of a particular research program, or the completion of a round of fellows. Entry and exit interviews are being conducted with all graduate fellows as they begin and complete their fellowships, and follow up on all fellows will be pursued on an annual basis to track effects of their involvement in the CNS program. Similar assessment of interns' experiences and knowledge acquisition is being conducted as they begin and conclude participation.

In addition we plan a formal larger scale evaluation exercise in the latter part of year 3, in order to assess the future course and funding needs of the CNS.

Prepare to meet changing conditions, emerging issues

This challenge of meeting changing conditions is particularly great in the context of studying nanotechnology in society, as the issues are far ranging and many of them still in development. Uncertainty about public reception to emerging technologies complicates this picture. We will be tracking change, both in the nanoscience and in the social world, and we will address these issues as they emerge. In particular, WG 3 is planning to track media uptake of nano and society, emerging social group formation and action, and fluctuations in public perceptions. These data will provide empirical data about the changing economic, political and social worlds in which nanotechnologies will unfold. The annual rotation of grad fellows provides one mechanism to respond to new research opportunities. Another is provided by plans for visiting scholars and CNS programming.

CNS-UCSB 2007 Annual Report—Appendix A
Participants 2007

Principal Investigator

Barbara Herr Harthorn, Women's Studies and Anthropology

Project Directors

Barbara Herr Harthorn, Women's Studies and Anthropology

Patrick McCray, History

CNS Executive Committee

Richard P. Appelbaum, Sociology and Global & International Studies

Bruce Bimber, Political Science and Communication, Co-PI

Fiona Goodchild, California NanoSystems Institute (CNSI), CNS Associate Director for Education

Barbara Herr Harthorn, Women's Studies and Anthropology, PI

Evelyn Hu, CNSI and Materials, Electrical and Computer Engineering (ECE), CNS Associate Director for Nanoscience, Co-PI

Patrick McCray, History, Co-PI

Christopher Newfield, English, Co-PI

Senior Personnel: Managers

Marisol Cedillo Dougherty, CNS manager

Meredith Murr, CNS Education Coordinator

Senior Personnel: Social Science and Nanoscience(UCSB unless noted)

Robert Ackland, Australia National University

Richard P. Appelbaum, Sociology and Global and International Studies

Kevin C. Almeroth, Computer Science

David W. Awschalom, Physics and California NanoSystems Institute

Gerald Barnett, Office for Management of Intellectual Property, UC Santa Cruz

Bruce Bimber, Political Science and Communication

Daniel Blumenthal, Electrical and Computer Engineering

Francesca Bray, Social Anthropology, Edinburgh University, UK

Kwang-Ting (Tim) Cheng, Electrical and Computer Engineering

Bradley F. Chmelka, Chemical Engineering

David Clarke, Professor of Materials

Gary Gereffi, Sociology, Duke University

Fiona Goodchild, CNS and CNSI

Michael F. Goodchild, Geography

Arthur C. Gossard, Materials, Electrical and Computer Engineering

Anita Guerrini, History and Environmental Studies

Elizabeth Gwinn, Physics

Barbara Herr Harthorn, Women's Studies and Anthropology

Evelyn Hu, CNSI and Materials, ECE
Milind Kandlikar, Institute for Resources, Environment and Sustainability, University of British Columbia
JoAnn Kuchera-Morin, Media Arts and Technology Program
Timothy Lenoir, Duke University
W. Patrick McCray, History
Umesh Mishra, Electrical and Computer Engineering
Cyrus Mody, Chemical Heritage Foundation
David Mowery, Haas Business and Public Policy, UC Berkeley
Christopher Newfield, American Culture
Laury Oaks, Women's Studies, Anthropology, and Sociology
Michael Osborne, History and Environmental Studies
Nicholas Pidgeon, Social Psychology, Cardiff University, Wales, UK
Tee Rogers-Hayden, Social Psychology, Cardiff University, Wales, UK
Theresa A. Satterfield, Institute for Resources, the Environment, and Sustainability, University of British Columbia
Suzanne Scotchmer, Economics and Public Policy, UC Berkeley
David Seibold, Communication
Ram Seshadri, Materials
Hyongsok (Tom) Soh, Mechanical and Environmental Engineering
Susan C. Stonich, Anthropology, Environmental Studies, Geography, and Interdisciplinary Marine Sciences
Matthew Tirrell, Chemical Engineering and Materials
Wim van Dam, Computer Science

Other Collaborators (UCSB unless noted)

James Blascovich, Social Psychology and Virtual Environments Research Lab
Patricia Holden, Bren School of Environmental Science and Management
Magali Delmas, Bren School of Environmental Science and Management
Nicola Spaldin, Chemistry
Craig Hawker, Materials Research Laboratory and MRSEC
Jim Reichman, NSF Center for Ecological Synthesis and Analysis
John Mohr, UC-AGEP

National Advisory Board members:

Thomas Kalil, University of California, Berkeley, Chair
Ann Bostrom, Georgia Tech
John Seely Brown, University of Southern California
Craig Calhoun, New York University
Vicki Colvin, Rice University
Ruth Schwartz Cowan, University of Pennsylvania
Susan Hackwood, California Council on Science and Technology
Julia Moore, Woodrow Wilson International
Martin Moskovits, API Nanotronics (on leave, UCSB)
Willie Pearson, Jr., Georgia Institute of Technology
Robert Westervelt, Harvard University

Nanotechnology in Society Network PIs:

David Guston, CNS-ASU
Davis Baird, University of South Carolina
Richard Freeman, Harvard University
Lynne Zucker, UCLA

Technical personnel

Eric Davila
Justin Dodds
Randall Ehrens (consultant)
Emily Kang (education)

Public Outreach Personnel

Valerie Walston, Communication Coordinator

Graduate Research Fellows and Associates (Social Science & NanoScience)

Kasim Alimahomed, Communication
Karl Bryant, Sociology
Yiping Cao, Bren School for Environmental Science
Joseph Conti, Sociology
Brian Ferguson, Mechanical Engineering
Hilary Haldane, Anthropology
Mary Ingram, Sociology
Erica Lively, Electrical and Computer Engineering
Gerald S. Macala, Chemistry
Tyronne Martin, Chemistry
Alexis Ostrowski, Chemistry
Rachel Parker, Sociology
Name Withheld, Chemistry
Kim Stoltzfus, Communication
Joseph Summers, Electrical and Computer Engineering
David Weaver, Political Science
Alan Glennon, Geography

Other Grads

Ryan Ong, Duke University
Cong Cao, State University of New York

Undergraduate Interns

William Bausman, University of California, Santa Barbara
Eric Gianella, Duke University
Gary L. Haddow, University of California, Santa Barbara
Name Withheld, University of California, Santa Barbara
Nicole Tyler, University of California, Santa Barbara
Guanglei Zhang, University of California, Santa Barbara

Community College Interns

Lamar Bush
Jason Cannon
Staci Chirchick
Josefina Garong
Name Withheld
Sarah Schultz

Partner Organizations

Australia National University
Cardiff University (UK)
Chemical Heritage Foundation
Duke University
University of British Columbia
University of California, Berkeley
University of California, Santa Cruz
University of Edinburgh (UK)

Network Institutions

Arizona State University
University of South Carolina
Harvard University/University of California, Los Angeles
Michigan State University
American Institute of Physics
Cornell University/National Nanotechnology Infrastructure Network
International Council on Nanotechnology (ICON)-Rice University
Environmental Defense
Nanoscale Informal Science Education (NISE) network
Woodrow Wilson International Center, Project on Emerging Nanotechnologies
International Risk Governance Council (Switzerland)

Educational Institutions

Allan Hancock
Howard University
Jackson State University
Oxnard College
Santa Barbara City College
University of Southern Florida

CNS-UCSB 2007 Annual Report—Appendix B
CNS-UCSB Network Activities and Presentations July 2006 – Dec 2007

CNS-UCSB researchers and collaborators have participated in an array of activities over the reporting period that have presented the Center's work, research as well as education and public outreach, to a wider audience. These meetings, presentations, and publications have also served as a means to build the "nano and society" network that the National Science Foundation has sought to create. Specific details are given below:

Research Presentations, Network Meetings, and Conferences Attended (or pending)

Rogers-Hayden, Tee, & Pidgeon, Nick. "Nano Jury UK: The 'Evaluators' Perspective," guest workshop participant, "Citizen Participation in Science and Technology: How to Design and Organize Deliberation, Citizen Participation in Science and Technology (CIPAST)," Dresden. June 26-28, 2006.

Pidgeon, Nick. "Trust, Risk and Public Engagement". Towards a Sustainable Energy Economy Workshop, University of Oxford. June 26-28, 2006.

Appelbaum, Richard P. "From Cheap Labor to High-Tech Leadership: Will China's Investment in Nanotechnology Pay Off?" Presidential panel, annual meetings of the Society for the Advancement of Socioeconomics (SASE), Trier, Germany. June 30-July 2, 2006.

Pidgeon, Nick. Participant, International Risk Governance Council, conference on Nanotechnology Risk Governance, Zurich, Switzerland. July 6-7, 2006.

Harthorn, Barbara Herr. "Nanotechnology and Society," UCSB RISE program. August 1, 2006.

Bimber, Bruce. "Nanotechnology and Social Movements," Plenary Address, Societal Impacts of Nanotechnology Conference, Australian National University, Canberra, Australia. August 3-4, 2006.

Rogers-Hayden, Tee, & Pidgeon, Nick. "Reflecting upon the First Citizens' Jury on Nanotechnology, Nano Jury UK" Reviewing Humanness: Bodies, Technologies and Spaces, European Association for the Study of Science and Technology (EASST) Conference, University of Lausanne, Switzerland. August 23-26, 2006.

Rogers-Hayden, Tee, & Pidgeon, Nick. "Creating the Future through Public Engagement on Nanotechnologies," Future Matters: Futures Known, Created and Minded, Cardiff University, United Kingdom. September 4-6, 2006.

Lenoir, Tim. "Visual Mapping of Nanotechnology Networks," November 2, Messy Shapes of Knowledge, Annual Meeting of the 4S Society, Vancouver, British Columbia. November 1-5, 2006.

- Harthorn, Barbara Herr, & Rogers-Hayden, Tee. Co-Chairs/Co-Organizers. "Risk Perceptions and Social Responses to Emerging Nanotechnologies," session at the Society for Social Studies of Science (4 S), Vancouver, British Columbia. November 2-4, 2006
- Harthorn, Barbara Herr, Haldane, Hillary, & Bryant, Karl. "Risk and Responsibility: How Nanoscientists and Engineers View the Nano-Enterprise," Society for Social Studies of Science (4S), Vancouver, British Columbia. November 2-4, 2006.
- Rogers-Hayden, Tee, & Pidgeon, Nick. "Deliberating Emerging Nanotechnologies in the UK and Beyond," Society for Social Studies of Science (4 S), Vancouver, British Columbia. November 2-4, 2006.
- Satterfield, Terre, & Kandlikar, Milind. "Expert Judgments of Public Perceptions: How Well Do They Know their Audience?" Society for Social Studies of Science (4S), Vancouver, British Columbia. November 2-4, 2006.
- Bimber, Bruce, & Weaver, David A. "Framing Nano in the News," annual meeting of Society for Social Studies of Science (4S), Vancouver. November 2-4, 2006.
- Mody, Cyrus. "Conferences, Community, and Nanotechnology: From Birth to Rebirth," Society for Social Studies of Science annual meeting, Vancouver. November 4, 2006.
- Harthorn, Barbara Herr. "NSEC: CNS-UCSB." NSF NSE NSEC PI meeting, Arlington, Virginia. December 4-6, 2006.
- Gereffi, Gary, & Ong, Ryan. "Upgrading in the Global Knowledge Economy: Insights from China and India." Presentation of conference paper Global Value Chains Workshop, "Industrial Upgrading, Offshore Production, and Labor," Center on Globalization, Governance & Competitiveness, Duke University, Durham, North Carolina. November 9, 2006.
- Mody, Cyrus. "Molecular Electronics in the Longue Durée," University of Pennsylvania Department of History and Sociology of Science, Philadelphia, Pennsylvania. November 13, 2006.
- Harthorn, Barbara Herr. "ICON Project: Global Survey of Industry Safety Handling Practices of Nano Materials," national press presentation teleconference/webcast, recorded and disseminated by ICON, Rice University, Houston, Texas. November 13, 2006.
- Mody, Cyrus. "The Long Arm of Moore's Law," Amherst College Law and Science Seminar, Amherst, Massachusetts. November 27, 2006.
- McCray, Patrick with Ingram-Waters, Mary. "Reconverging Technologies: Space, Nano, and Fountains of Paradise," paper to be presented at annual meeting of the Society for History of Technology, Washington, DC. 2007.

- Mody, Cyrus. "Building a Probe Microscopy Community," Pittsburgh Conference, 18th Annual James Waters Symposium Recognizing Pioneers in the Development of Analytical Instrumentation, Chicago, Illinois. 2007.
- Appelbaum, Richard P., & Parker, Rachel. "China's Move Into Nanotechnology: The High Road to Development," East Asia Center, University of California, Santa Barbara, California. January 30, 2007.
- Mody, Cyrus. "Some Thoughts on Why History Matters in Understanding the Social Issues of Nanotechnology and Other Converging Technologies," Spanish National Research Council, "Making the CTEKS" workshop, Madrid, Spain. February 6, 2007.
- Appelbaum, Richard P. "Innovation or Imitation? China's Bid to Become a Global leader in Nanotechnology," Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies, Program on Nanotechnology in China: Ambitions and Realities, Washington, DC. February 6, 2007.
http://www.wilsoncenter.org/index.cfm?fuseaction=events.event_summary&event_id=218854
- Harthorn, Barbara Herr & Earl, J. Center for Information Technology and Society and Center for Nanotechnology in Society reception for prospective students, University of California, Santa Barbara. February 8, 2007.
- Harthorn, Barbara Herr, & Bryant, Karl. Co-Organizers/Co-Facilitators, Nanotechnology Public Deliberation Workshop, Health and Human Enhancement Technologies, Santa Barbara. February 10, 2007.
- Harthorn, Barbara Herr, & Bryant, Karl. Co-Organizers/Co-Facilitators, Nanotechnology Public Deliberation Workshop, Energy Technologies, Santa Barbara, California. February 11, 2007.
- Mody, Cyrus. "Molecular Electronics in the Longue Durée: Microelectronics, Futurism, and Nanotechnology," Rice University, Department of History, Houston, Texas. February 12, 2007.
- Appelbaum, Richard P. "China's Bid to Become a leader in Nanotechnology," UCSB Department of Geography Colloquium. March 8, 2007.
- McCray, Patrick. Presentation of WG1 research, PIs meeting at the NSF. March 14-17, 2007.
- Harthorn, Barbara Herr. "CNS-UCSB Overview," "Working Group 3: Risk Perception and Social Response," "Nanotechnology in Society -- Future Directions," NSF Nano in Society PI meeting, Arlington Virginia. March 15-16, 2007.

- Harthorn, Barbara Herr. NSF Nano in Society Pls meeting, Arlington, Virginia. March 15-16, 2007.
- Mody, Cyrus. "Molecular Electronics and the Microelectronics Origins of Nanotechnology," Nano and Giga Challenges in Electronics and Photonics Symposium, Tempe, Arizona. March 16, 2007.
- Appelbaum, Richard P. "China's Bid to Become a leader in Nanotechnology," Chancellor's Community Breakfast, Santa Barbara, California. March 19, 2007.
- Lenoir, Tim. "Visual Mapping of Nanotechnology Networks," presented at the annual meeting of the Center for Genome Ethics Law and Policy at Duke University, Durham, North Carolina. March 23, 2007.
- Gereffi, Gary, Stacey, Frederick, & Ong, Ryan (2007). "Nanotechnology in North Carolina," presentation at "Nanotechnology and the Emerging Global Knowledge Economy: Challenges and Opportunities in an International Context" conference, Center on Globalization, Governance & Competitiveness, Duke University, Durham, North Carolina. March 29, 2007.
- Appelbaum, Richard P., and Parker, Rachel. "Nanotechnology in a Global Context: The Case of China," presentation at "The Global Knowledge Economy: Current Issues and Trends in the United States, East Asia, and Europe," conference at the Center on Globalization, Governance, and Competitiveness, Duke University, Durham, North Carolina. March 29-30, 2007.
- Gereffi, Gary. "Visual Mapping of Nanotechnology Networks," presented at "Nanotechnology and the Emerging Global Knowledge Economy: Challenges and Opportunities," Duke University, Durham, North Carolina. March 29-30, 2007.
- Appelbaum, Richard P. "The Impact of Ending the Multifibre Arrangement on Apparel-Exporting Developing Countries – With a Brief Detour into China's Emergence as a High-Tech Power, and Some Possible Implications for Developing Countries," presentation at "The Rise of the New Asian Giants: Adaptive Strategies in the Global Economy" conference at the Watson Institute for International Studies, Brown University, Providence, Rhode Island. April 13, 2007.
- Lenoir, Tim. "Contemplating Singularity: On Nanomachines and Postbiological Selves," April 21, Interfaces and Visualizations: A State-of-the-Art Conference on the Humanities in Post-Human Times, University of Illinois. April 20-21, 2007.
- Harthorn, Barbara Herr, & McCray, Patrick. Annual Meeting of the CNS National Advisory Board, Santa Barbara, California. April 23-24, 2007.
- Harthorn, Barbara Herr, & McCray, Patrick. External Site Review, CNS-UCSB, Santa Barbara, California. April 24-26, 2007.

- Harthorn, Barbara Herr. "Nanotechnology, Risk, and Societal Response," Nano Roundtable, Goldman School of Public Policy, University of California, Berkeley, California. May 4, 2007.
- Pidgeon, Nick. "Risk Perception and Communication Related to Nanotechnologies." NNI/RVO/IMEC Nanotech Outreach Workshop, Leuven, Belgium. May 7-8, 2007.
- Gibson, R., Lusoli, W., Ward, S., & Ackland, Robert. "Mapping "Small Things" on the Web: The Pro- and Anti-Nanotech Debate Online," meeting of the International Communication Association. San Francisco California. May 24-28, 2007.
- Harthorn, Barbara Herr. "Interdisciplinary Social Science-STEM Graduate Education at the CNS-UCSB," UC DIGSSS/AGEP Conference, Santa Barbara, California. May 25, 2007.
- Lenoir, Tim. "Contemplating Singularity: On Nanomachines and Postbiological Selves," Media, Technology, and Society Program, Northwestern University School of Communication. May 26, 2007.
- McCray, Patrick. "Over the Red Brick Wall: Spintronics as an Over-the-Horizon Technology," paper presented at Wharton-Chemical Heritage Foundation Symposium on Social Studies of Nanotechnology, Philadelphia. June 2007.
- Ingram-Waters, Mary. "Spaceflight, Frostbite, and Foresight: Exploring the Connections between the Pro-Space, Cryonics, and Nanotechnology Social Movements," poster presented at Chemical Heritage Foundation - Wharton Joint Symposium on Nanotechnology, Philadelphia, Pennsylvania. June 2007.
- Lenoir, Tim. Joint Wharton-Chemical Heritage Foundation Symposium on Social Studies of Nanotechnology, Wharton School, University of Pennsylvania. Philadelphia, Pennsylvania. June 7, 2007.
- Pidgeon, N. "Risk Perception and Communication Related to Nanotechnologies." European Science Foundation 1st Summer School on Nanomedicine, University of Cardiff. Cardiff, UK. June 10-15, 2007.
- McCray, Patrick. "Spintronics, Novelty, and Over-the-Horizon Technologies," paper presented at the Spintech IV conference, Maui. June 16-21, 2007.
- Harthorn, Barbara Herr, & Bryant, Karl. "Understanding Nanoscale Scientists' Attenuation Under Uncertainty," paper presented in "Nanotechnologies: Emerging Risks and Societal Responses" panel at the Society for Risk Analysis-Europe, The Hague, Netherlands. June 17-19, 2007
- Lenoir, Tim. "Strategies for Data Mining, Mapping and Visualization of Emerging Nanotechnologies," lecture to the Visualization Group at the Zentrum für Interdisziplinäre Forschung (Zif), Bielefeld, Germany. June 18, 2007.

- Pidgeon, Nick, & Harthorn, Barbara Herr. Co-Chairs/Co-Organizers, “Nanotechnologies: Emerging Risks and Societal Responses I and II,” Special symposium at the Society for Risk Analysis-Europe, The Hague, Netherlands. June 17-19, 2007.
- Rogers-Hayden, Tee, & Pidgeon, Nick. Opening up Nanotechnology Dialogue with the Publics: Risk Communication or ‘Upstream Engagement’? Paper presented in Nanotechnologies: Emerging Risks and Societal Responses, panel at the Society for Risk Analysis-Europe, Building Bridges: Issues for future risk research, The Hague, Netherlands. June 17-19 2007.
- Satterfield, Terre, and Kandlikar, Miland. “Expert Judgments of Public Perceptions: How Well Do They Know Their Audience?” Paper presented in Nanotechnologies: Emerging Risks and Societal Responses, panel at the Society for Risk Analysis-Europe, Building Bridges: Issues for future risk research, The Hague, Netherlands. June 17-19 2007.
- Pidgeon, Nick, & Harthorn, Barbara Herr. Co-Chairs/Co-Organizers, “Nanotechnologies: Emerging Risks and Societal Responses,” panel at the Society for Risk Analysis-Europe, The Hague, Netherlands. June 18-19, 2007.
- Harthorn, Barbara Herr. “CNS-UCSB: Overview of Research, Education, and Engagement Programs,” presentation in CNS program for incoming summer interns. June 25, 2007.
- Pidgeon, Nick. Attended the first meeting of (and is a full member of) the UK Royal Society / Nanotechnology Industries Association working group that is developing a code of practice for responsible development of nanotechnologies. June 25, 2007.
- Harthorn, Barbara Herr. “NanoCafe: Nano-Medicines and Societal Issues,” to be conducted, Santa Barbara, July 18, 2007.
- McCray, Patrick, & Harthorn, Barbara Herr. Co-Chairs/Co-Organizers. “Studying the Nano-Enterprise,” Panel accepted for 4S meetings, Montreal, Canada. October 11-13, 2007.
- Ingram-Waters, Mary. “From Spaceflight to Foresight: Tracing The Social Movement Spillover Between Space and Nano.” Paper to be presented at annual meeting of the Society for the Social Studies of Science, Montreal. October, 2007.
- Satterfield, Terre, Harthorn, Barbara Herr, & Kandlikar, Miland. “Research and Development in an Age of Upstreaming,” paper to be presented at the “Studying the Nano-Enterprise” panel for 4S meetings, Montreal. October 11-13, 2007.
- Rogers-Hayden, Tee, & Bryant, Karl. “Deliberating Nanotechnology Risks: UK and US Perspectives,” paper to be presented at the “Studying the Nano-Enterprise” panel for 4S meetings, Montreal, Canada. October 11-13, 2007.

Newfield, Christopher. "Next Generation of Technology Transfer: Current Policy Limitations for Nanoscale Research," paper to be presented at the "Studying the Nano-Enterprise" panel for 4S meetings, Montreal, Canada. October 11-13, 2007.

Appelbaum, Richard. "China's Bid to Become a Global Leader in Nanotechnology," paper to be presented at the "Studying the Nano-Enterprise" panel for 4S meetings, Montreal, Canada. October 11-13, 2007.

Lenoir, Tim & Gianella, Eric. "Technology Platforms in the Landscape of Contemporary Science" paper to be presented at the "Studying the Nano-Enterprise" panel for 4S meetings, Montreal, Canada. October 11-13, 2007.

Friedman, Sharon, & Harthorn, Barbara Herr. Co-Chairs/Co-Organizers, panel on "Nanotechnology, Risk, and Society" under review for AAAS, Boston, Massachusetts. February 15-19, 2008.

CNS-UCSB 2007 Annual Report—Appendix C
Publications and Reports by CNS researchers from July 2006 through December 2007

- Harthorn, Barbara Herr, McCray, W. Patrick & Satterfield, Terre. "Anthropological Research at the UCSB Center for Nanotechnology in Society." *Practicing Anthropology* (special issue on nanotechnology) 28, 2 (2006): 38-40.
- Rogers-Hayden, Tee, & Pidgeon, Nick. "Reflecting upon the UK's Citizens' Jury on Nanotechnologies: Nano Jury UK." *Nanotechnology Law and Business* 2 (2006), 3: 167-178.
- Lenoir, T. and Giannella. E. "The Emergence and Diffusion of DNA Microarray Technology." *Journal of Biomedical Discovery and Collaboration* 1(11). (2006).
- Pidgeon, Nick. "Opportunities and uncertainties: the British nanotechnologies report and the case for upstream societal dialogue." In K. Andersson (ed.) *Proceedings of VALDOR*. Stockholm:Congrex Sweden, AB (2006): 371-378.
- Pidgeon, Nick. "Risk and Uncertainty." *Trust in Science: The Dialogue with Society*. Berlin: Ernst Schering Foundation and the British Council: 40-45. (2006).
- Appelbaum, Richard P., Gereffi, Gary, Parker, Rachel, & Ong, Ryan. "From Cheap Labor to High-Tech Leadership: Will China's Investment in Nanotechnology Pay Off?" CNS working paper, June 26, 2006. Available online at: (http://www.cns.ucsb.edu/index.php?option=com_remository&Itemid=100&func=startdown&id=13)
- Harthorn, Barbara Herr. "Nano-Buzz: Societal Dimensions of Emerging Technologies." *Anthropology News* (October 2006): 26.
- McCray, Patrick W. "MBE Deserves a Place in the History Books." *Nature Nanotechnology*, 2, 5 (2007): 2-4.
- Rogers-Hayden, Tee, & Pidgeon, Nick. "Moving Engagement 'Upstream'? Nanotechnologies & the Royal Society and Royal Academy of Engineering's Inquiry," *Public Understanding of Science*, Special Issue, 16 (2007): 345-364.
- Pidgeon, Nick, & Rogers-Hayden, Tee. "Opening up Nanotechnology Dialogue with the Publics: Moving Beyond Risk Debates to 'Upstream Engagement.'" In A. Anderson, A. Petersen, S. Allan and C Wilkinson (eds.). *Health, Risk & Society, Special Issue 9*, 2 (2007): 191-210.
- Kandlikar, Milind, Ramachandran, Gurumurthy, Maynard, Andrew, Murdock, Barbara, & Toscano, William A. "Health Risk Assessment for Nanoparticles: A Case for Using Expert Judgment." *Journal of Nanoparticle Research*, 9 (1) (January 2007): 137 – 156.

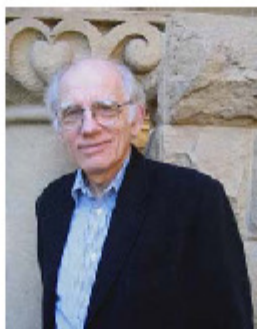
- Appelbaum, Richard P. "Survey of Participants, NSF-Sponsored US-China Workshop on Nanotechnology, March 22-24, 2006," internal report to NSF, based on survey of 20 Chinese and 20 US conference participants, evaluating conference and soliciting suggestions for future conferences (February 15, 2007).
- Rogers-Hayden, Tee, Pidgeon, Nick, Mohr, A., Guston, D., & Wynne, B. (Eds). "*Engaging with Nanotechnologies-Engaging Differently?*" *Nanoethics, Special Issue*, submitted and expected in July 2007.
- Rogers-Hayden, Tee, & Pidgeon, Nick. "Developments in Public Participation in Nanotechnology: towards Sustainability." In H Kastenholz and A Helland (eds.) *Nanotechnology Development in Light of Sustainability. Journal of Cleaner Production*, Special Issue, submitted and expected in 2007.
- Mody, Cyrus & Choi, Hyungsub. In press. "Molecular Electronics in the *Longue Durée*: The Microelectronics Origins of Nanotechnology." *Social Studies of Science*, accepted for publication and to appear in 2008.
- Mody, Cyrus. "Some Thoughts on Why History Matters in Understanding the Social Issues of Nanotechnology and Other Converging Technologies." *Nanoethics*, submitted and under review.
- Mody, Cyrus. "Building a Probe Microscopy Community." *Journal of Chemical Education*, submitted and under review.
- McCray, Patrick W. "Over the Red Brick Wall: Spintronics, Novelty, and Over-the Horizon Technologies." *History and Technology and Technology and Culture*, submitted and under review.
- Appelbaum, Richard P., & Parker, Rachel. "Innovation or Imitation? China's Bid to Become a Global leader in Nanotechnology." *Science and Public Policy*, submitted and under review.
- Weaver, David & Bimber, Bruce. "Measuring News Events: A Comparison of Searches Using Lexis-Nexis and Google News." *Political Communication*, submitted and under review.
- Ackland, Robert & O'Neill, Mathiu. "Nanotechnology and Online Environmental Activism." *American Sociological Review*, submitted and under review.



Center for Nanotechnology in Society
Seminar Series



Ethics and Nanotechnology: Mapping the Views of the NNIN Community



Robert McGinn

Director, Program in Science, Technology &
Society
Stanford University

**Thursday January 11, 3pm
3001 CNSI**

Nanotechnology and Religion: Ambitions, Influence, and Policy



Prof. Jamey Wetmore

Consortium for Science, Policy, and Outcomes
Arizona State University

Tuesday February 6, 2007

3:00 – 4:30 PM

McCune Conference Room, 6th Floor
HSSB

NANOTECHNOLOGY:

What is it?

How could it change our lives?

Will there be any risks?

*Learn about nanotechnology, discuss its implications,
and share your views in a casual café setting*

Nano Café

Wednesday, April 11

7:00 – 8:00 p.m.

**Lobby, California NanoSystems Institute
UC Santa Barbara**

Wine and cheese will be served

Free and open to the public

No science background required

Space is limited. RSVP to cnsievents@cnsi.ucsb.edu or (805) 893-6025

Societal Implications of Nanotechnologies – And Their Ambivalencies

Thursday, May 24

Noon – 1:30 pm

Engineering Science Building (ESB) Room 2001



Prof. Arie Rip

Philosophy of Science and Technology
School of Management and Governance
University of Twente, The Netherlands

Professor Rip is a key figure in the Centre for Studies of Science, Technology and Society. He is involved in evaluation studies, as part of the Norwegian Research Council, and the research management of Flemish Universities, and international comparative science policy studies. He was a member of the European Union High-Level Expert Group on Foresighting the New Technology Wave.

Prof. Rip's talk will provide an overview of nanotechnology and its impacts to society, as well as identify eight key ambivalencies that arise as a result of nanotechnology's rapid growth and progress.

Lunch will be provided

Questions: valerie@cns.ucsb.edu, x8850

Could this new technology
revolutionize patient care,
diagnosis and treatment?

MEDICAL NANOTECHNOLOGIES

*Come learn about nanomedicine and its applications
from UCSB experts in the field,
and share your views in a casual café setting*



Nano Café

Wednesday, July 18

7:00 – 8:00 p.m.

Coffee Cat

1201 Anacapa Street

Santa Barbara

Free and open to the public

No science background required

Space is limited. RSVP to cnsievents@cnsi.ucsb.edu or (805) 893-6025





2007/2008 Graduate Research Fellowships in Social Sciences and Humanities

The Center for Nanotechnology in Society at the University of California, Santa Barbara (CNS-UCSB) announces several fellowship opportunities for outstanding graduate students pursuing research in the social sciences and humanities. CNS researchers are engaged in several areas of inquiry including:

- the historical context of nanotechnologies
- innovation, intellectual property, and globalization
- risk perception, social response, and public participation

Graduate fellows will be in residence at UCSB and expected to interact with faculty, researchers, and other students at the CNS-UCSB. CNS Graduate Fellows will be sponsored by a faculty member who is affiliated with the Center. All Fellows will be engaged in research and educational opportunities that will further their own professional development. The fellowship will provide up to \$27,000 for a 12 month period of residence at the CNS-UCSB beginning June 18, 2007.

Please visit our website for complete information and application materials

<http://www.cns.ucsb.edu/education-public-engagement/>

Or e-mail Fiona Goodchild, CNS Associate Director of Education at fiona@cnsi.ucsb.edu

Application Deadline is March 1st, 2007



NATIONAL
NANOTECHNOLOGY
INITIATIVE

2007/2008 Graduate Research Fellowships in Science and Engineering

Are you a science or engineering graduate student interested in:
Science Policy?

Technology and Innovation?

The Societal Impacts of Science and Technology?

The Center for Nanotechnology in Society at the University of California, Santa Barbara (CNS-UCSB) announces several fellowship opportunities for outstanding graduate students pursuing research in science and engineering. CNS researchers are engaged in several areas of inquiry including:

- the historical context of nanotechnologies
- innovation, intellectual property, and globalization
- risk perception, social response, and public participation

These graduate fellowships are intended for science and engineering graduate students currently enrolled at UCSB. The fellows will be funded half-time (equivalent to a 25% TA-ship) and will pursue research with a faculty member who is affiliated with the Center to examine the societal issues of nanotechnology concurrently with their science and engineering research. All CNS Fellows will engage in research and educational opportunities that will further their professional development. All graduate fellows will be sponsored by a faculty member who is affiliated with the Center. The fellowship will provide up to \$13,500 for a year-long appointment beginning June 18, 2007, although quarterly appointments are possible.

Please visit our website for complete information and application materials:

<http://www.cns.ucsb.edu/education-public-engagement/>

Or email Fiona Goodchild, CNS Associate Director of Education at fiona@cnsi.ucsb.edu

Application Deadline is March 1st, 2007



NATIONAL
NANOTECHNOLOGY
INITIATIVE

Undergraduate Summer Research Internships

Center for Nanotechnology in Society
University of California, Santa Barbara

Program Dates: June 25 - August 17, 2007



**Have you ever
wondered how
nanotechnologies
might change
society?**

The Undergraduate Summer Research Internships in the Center for Nanotechnology in Society (CNS) bring science, engineering, and social science majors to UCSB for a summer research experience. Interns are individually matched with a mentor and gain first-hand experience investigating the societal impacts of nanotechnology with top researchers in the country. Interns also attend weekly meetings, special seminars and develop presentation skills.

- Internships will be awarded in the areas of nanotechnology and social science to current UCSB undergraduates
- The stipend for undergraduate interns is \$2,800 total for 8 weeks
- We will provide up to \$800 for housing expenses

Please visit our website for complete information and application materials
<http://www.cns.ucsb.edu/education-public-engagement-5/>

Or e-mail Meredith Murr, CNS Education Coordinator at murr@cns.ucsb.edu

Application Deadline is April 15, 2007





TECHNOLOGY & SOCIETY GRADUATE RECEPTION

ARE YOU INTERESTED IN THE INTERSECTION OF TECHNOLOGY WITH SOCIETY?

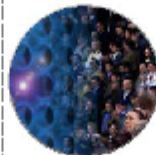
Come join us for a reception to learn more about graduate studies, research, and fellowship opportunities that explore the implications of technology in society. UCSB's Center for Information Technology & Society (CITS) and Center for Nanotechnology in Society (CNS) are jointly hosting a reception for graduate students to join faculty and students currently involved in the Technology & Society Ph.D. emphasis and CNS fellow program to learn about and discuss campus opportunities.

Thursday February 8, 2007
12 - 1PM

Room 2206 North Hall
Light lunch will be provided

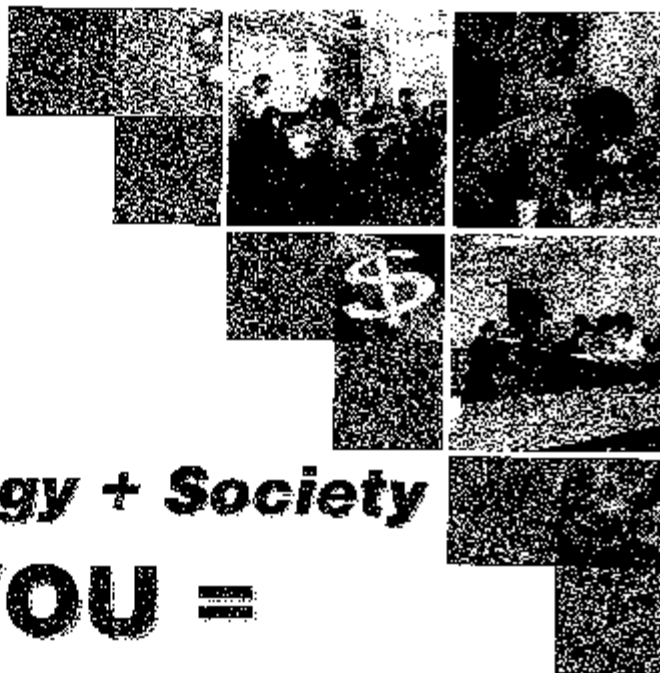


Center for Information
Technology and Society
www.cits.ucsb.edu
Contact: Rob Patton
893-5910 or patton@cits.ucsb.edu



Center for Nanotechnology
in Society
www.cns.ucsb.edu
Contact: Marisol Cedillo Dougherty
893-7743 or marisol@cns.ucsb.edu

INSCITES
*Insights on Science and
Technology for Society*



Technology + Society + YOU = A New INSCITES Course

Fellowship Opportunity for Graduate Students:

Develop and teach a new integrative undergraduate course on the science, economics, history, and sociology of innovative technologies as an INSCITES Teaching Scholar. Graduate Teaching Scholars will receive **\$12,000 in stipend** for the year, and will engage in the following activities:

Overview of Activities

Fall: Select course topic and determine course structure

Winter: Develop course materials for lecture and labs

Spring: Teach course and evaluate

Questions? Contact Evelyn Hu (hu@ece.ucsb.edu) or Meredith Murr (murr@cnsi.ucsb.edu)

**Please see www.cnsi.ucsb.edu/inscites/scholars/
for application materials.**

Applications are due July 15, 2007.

Wm St 186 BH
 MW 12:30-1:45 TD 2600
 Title: Gender, Science, and New Technologies
 Professor: Barbara Herr Harthorn

Main topics:

- * Women in Science
- * Feminist critiques of science
- * Cross-cultural/global analysis of emerging technologies
- * Technological progress and societal risk



GOVERNMENT MUST ACT ON THREAT FROM POISON SHIP	Nanny state has 'stolen the lives of our children'	Enjoy the perils of play: Let children take risks outdoors, parents told
There are limits to how far governments can protect people	Be prepared to take risks	Bicycle bell crackdown has the ring of a nanny state
Nanny state row as schools are told to weigh children	Wearing a helmet puts you at greater risk, cyclists warned	Young ignore sun cancer risks for tan
Regulation may be restricting but it does help	Classroom health rules 'deny science pupils the chance to run experiments'	Frequent fliers ignore health risk
	Government must target the genuine security risks	Protecting yourself

Please contact the Women's Studies Department for more information:
 4631 South Hall, Phone:(805)893-4330, email:wmst@womst.ucsb.edu