

Center for Nanotechnology in Society

NSF NSEC Grant 0938099

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The Center for Nanotechnology in Society at UCSB promotes the study of societal issues connected with emerging nanotechnologies in the US and around the globe. The global vision for nanotechnology to mature into a transformative and beneficial technology depends on an array of interconnected and complex factors situated within a rapidly changing international economic, political, and cultural environment. These include the resolution of scientific and technological questions, the safe creation, development, and commercialization of nano-products, and the acceptance of nanotechnology by diverse publics. CNS-UCSB serves as a national research and education center, providing a clear and comprehensive approach to understanding challenges to successful development of nanotechnologies in the Americas, Europe, Asia and other regions. Through a mixed, complementary portfolio of interdisciplinary research, education, and engagement activities, CNS-UCSB produces basic knowledge about a linked set of social, economic, and environmental issues at a time of sustained technological innovation. The Center addresses education for a new generation of social science and nanoscience professionals as it fosters research on the origins of the nano-enterprise, the globalization of nanotechnology, and risk perception and media framing of nanotechnologies' benefits and risks.



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 socially responsible development of nanotechnologies. Close ties with the internationally prominent nanoscale researchers connected with the California NanoSystems Institute, Materials Research Laboratory (MRSEC), NNIN, UC Center for Environmental Implications of Nanotechnology, and with social science research centers at UCSB focused on relations among technology, culture, and society are enhanced by research collaborators in the US at UC Berkeley, UC Davis, UCLA, the Chemical Heritage Foundation, Decision Research, Duke Univ., Lehigh Univ., Long Island Univ., Quinnipiac Univ., Rice Univ., Science and Technology Policy Institute (DC), SUNY New Paltz, Univ. of S. Carolina, Univ. of Wash., and Univ. of Wisc.-Madison, and abroad at Beijing Inst. of Tech., China, Cardiff Univ., UK, Centre National de la Recherche Scientifique, FR, Univ. of British Columbia, CA, Univ. of Edinburgh, UK, University of Gothenburg, Sweden, and Univ. of Nottingham, UK.

The center addresses questions of nanotech-related societal change through research that encompasses three linked areas:

- **IRG 1. Origins, Institutions, and Communities** examines instrumentation, research communities, scientists' careers, national and state policy, and the role of public imagination.
- **IRG 2. Globalization and Nanotechnology** develops a comprehensive understanding of state policies, collaboration and competition in the global development of nanotechnology with an emphasis on Asia and Latin America.

- **IRG 3. Nanotechnology Risk Perception and Social Response** studies risk and benefit perception among the multiple stakeholders in the nanotech enterprise; media framing of nano risks; and methods for engaging diverse US publics in upstream/midstream deliberation about new technologies in society.

The **Origins, Institutions, and Communities** group (**IRG 1**) establishes the historical contexts for the emergence of nanotechnology as a research field, a component of US science policy, and an element in popular imaginings of future technologies. Together with colleagues at Rice University, the University of South Carolina, and the Chemical Heritage Foundation, IRG-1 explores topics related to nanotech's history, including research policies for micro/nanoelectronics, what the historical context is for interdisciplinary research in American nanotech labs, how federal research policies have helped foster new areas of research that bridge the physical and life sciences, and the emergence of new research areas such as DNA nanotechnology. A recent outcome includes:

- Cyrus C.M. Mody, *Instrumental Community: Probe Microscopy and the Path to Nanotechnology* (Cambridge: The MIT Press, 2011).

IRG 2, the Globalization and Nanotechnology group, focuses on national industrial policies and international collaboration as central factors in the development of nanotechnology in key Asian countries, Latin America, and the U.S. The group is extending its research beyond R&D in China to include a comparative study of nanotechnology policy in Korea, Japan, Mexico, and the United States, and is currently focusing on the extent to which China has been successful in commercializing nanotechnology. In collaboration with Duke University IRG2 is using patent data to examine the role of multicountry collaborations in fostering high impact research and commercial innovation. Duke colleagues are also developing a website employing a global value chain (GVC) framework to chart the role of California nanotechnology in the global economy. Recent findings:

- While China has made significant research advances in such areas as water filtration and targeted drug delivery, in terms of commercialization a major strength lies in the production of raw nanomaterials. Paradoxically, even as China invests in advanced technologies in hopes of "leapfrogging development" and thereby moving away from its role as the world's workhouse, many Chinese nanotech firms remain low-cost nanomaterial suppliers to foreign multinationals (Appelbaum, Parker, and Cao, *Global Networks* 11:3, Winter 2011: 298-314).

The **Nanotechnology Risk Perception and Social Response (IRG 3)** group, with lead collaborators at University of British Columbia (Canada), Cardiff University (UK), and UCSB, has developed a solid knowledge base about public, scientist, industry, and regulator perceptions of nanotech risk, shifting media coverage that influences such views (via collaboration with Lehigh U), and modes of engaging diverse members of the public in dialogue about new technologies and society. New approaches ahead include decision pathway and mental models research on emergent public views (with collaborators at Decision Research); regulatory challenges and responses (with Univ of Wisconsin); survey work on nano consumer products; gender and race in public participation; collective action; and development of responsible risk communication in conditions of uncertainty. Recent findings:

- In surveys of US public, application domain and social context in which nanotechnologies are encountered are found to be important to public acceptability, and

questions of equity, vulnerability and distributional justice appear likely to be critical to the success of the nanotechnology enterprise (Conti, Satterfield & Harthorn, *Risk Analysis* Nov 2011).

Novel cross-IRG initiatives draw on key UCSB strengths by targeting strategic nanotech application areas in energy (with an emphasis on solar), environment, water, health, and food; spatial analysis and the global value chain; and equitable development. Collaborators at Lehigh Univ. pursue research on traditional and new social media framing of nano technologies.

Education and Public Engagement programs at CNS-UCSB aim to nurture an interdisciplinary community of nanoscale scientists & engineers (NSE), social scientists, and educators, and to achieve *broader impacts* through engagement of diverse audiences in dialogue about nanotechnology and society. In addition to a thriving Postdoctoral Scholars program (5 scholars in 2011), CNS-UCSB's unique fellowship program for graduate students in both social sciences and NSE provides research training, mentoring and professional

development to a diverse cohort of outstanding students (11 students in 2011). In Summer 2011, the Center hosted its 6th 8-week Undergraduate Research Internship program, hosting 3 California community college students recruited through a partnership with the UCSB CNSI. In Spring 2011, CNS-UCSB faculty and staff collaborated with faculty from Santa Barbara City College to develop and offer a new semester-long community college-level course, *Nanoscience in Society*. Knowledge transfer activities included sharing information and engaging in dialogue about the novel work pursued by CNS-UCSB with multiple audiences,



including campus and academic communities, general audiences, public policy makers and industry experts. CNS-UCSB Director Barbara Harthorn co-organized the 3rd international meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET) in Tempe, AZ in November, 2011, attended by almost 200 scholars. CNS-UCSB



researchers and education staff made 116 presentations during the 2010-2011 reporting year. The Center continued its popular programs of promoting dialogue between the general public and NSE researchers through its NanoMeeter series, supported general education about nanotechnology through NanoDays 2011, and provided electronic dissemination of a popular nano and society-related Weekly News Clips service. CNS-UCSB has been a connector for the growing nano in society community, and is increasingly seen as a research hub and dissemination portal for that community.

International Collaborations are central to CNS-UCSB's ongoing work and include leading universities and institutes in Canada, the UK, France, and China. CNS-UCSB is a founding member and lead partner in the Society for the Study of Nanoscience and Emerging Technologies (S.NET), and co-hosted, with CNS-ASU, its 3rd annual meeting in Tempe, Arizona in Nov 2011. This organization is fostering dialogue among nano and society researchers around the globe. With funding from the UC MEXUS program, CNS-UCSB is working with Mexican colleagues to examine bilateral (USA-Mexico) collaborations in the development of nanotechnology.

References [1] For further information about this project please see our website at <<http://cns.ucsb.edu>> or email harthorn@cns.ucsb.edu