Center for Nanotechnology in Society

NSF NSEC Grant SES-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. Realizing 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 N. America, Europe, Asia, and Latin America. Through a mixed, complementary portfolio of interdisciplinary research, education, and engagement activities, CNS-UCSB researchers address a linked set of social and environmental issues regarding the domestic US and global creation, development, commercialization, production, consumption, and control of specific kinds of nanoscale technologies. 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 multi-stakeholder perception 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 at UCSB connected with the California NanoSystems Institute, Materials Research Laboratory, NNIN, UC Center for Environmental Implications of Nanotechnology, and with social science research centers focused on relations among technology, culture, and society are enhanced by research collaborators in the US at UC Davis, UCLA, Decision Research, Drexel Univ., Duke Univ., Kauffman Fdn, Lehigh U, Long Island U, Occidental College, Quinnipiac U, Rice U, Science & Technology Policy Institute, Southern Methodist U, SUNY New Paltz, U of S. Carolina, and abroad at: Beijing Inst. of Tech., China; Cardiff U, UK; Centre National de la Recherché Scientifique, FR; Compass Resource Management, Canada; Federal U of Parana, Brazil; Seoul National U, S. Korea; U of Arizona; U. Autónoma de Zacatecas, Mexico; U of British Columbia, Canada; U of Edinburgh, UK; U of Gothenburg, Sweden; U of Nottingham, UK; and U of Toronto, Canada.

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

- **IRG 1. Origins, Institutions, and Communities** produces and integrates a diverse range of historical sources and research tools in order to understand specific facets of the nano-enterprise's history.

- **IRG 2. Globalization and Nanotechnology** develops a comprehensive understanding of the role of industrial policy in shaping nanoscale R&D and commercialization in China, Korea, Japan, Latin America, and the U.S; and the role of multicountry collaborations in high-impact research and commercial innovation.
- **IRG 3. Nanotechnology Risk Perception and Social Response** conducts social research on formative and evolving nanotech risk and benefit perceptions in the US and abroad aimed at studying perceptions of emerging nanotechnologies by multiple stakeholders in the nano-enterprise and cross-national modes of enhancing public participation.

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, Southern Methodist University, University of South Carolina, University of Toronto, and 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. 2013. "Santa Barbara, Physics, and the Long 1970s," *Physics Today* 66.9: 31-37

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 and the U.S. The group has extended its research beyond R&D in China to include a comparative study of nanotechnology policy in Korea, Japan, selected Latin American countries, and the United States. It has also initiated research that analyzes the extent to which China has been successful in commercializing nanotechnology. IIRG2 is also conducting bibliometric analysis of patent and publication data to better understand the determinants of nanotechnology innovation in China and Latin America. Colleagues at Duke University have developed a website employing a global value chain (GVC) framework to chart the role of California nanotechnology in the global economy. This will be expanded to the entire United States. **Recent findings:**

- Richard Appelbaum and Rachel Parker. 2013. "Nanopolis and Suzhou Industrial Park: China's Silicon Valley?" (completed, to be submitted)
- Richard Appelbaum, Matt Gebbie, Shirley Han, and Galen Stocking. 2013. "Can China Become a Nanotech Innovator?"(completed, to be submitted)

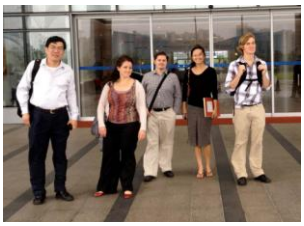
The **Multi-stakeholder Risk Perception and Social Response** (**IRG 3**) group, with lead collaborators at University of British Columbia (Canada), Cardiff University (UK), and UCSB, has developed an extensive comparative and longitudinal knowledge base about public, scientist, industry, regulator and NGO perceptions of nanotech risks and benefits, and modes of engaging diverse members of the public (including women and people of color) in dialogue about new technologies and society. IRG 3 also collaborates with the UC Center for Environmental Implications of Nanotechnology, providing research on perceptions of potential environmental hazards posed of manufactured nanomaterials. New work in progress includes decision pathway and cross-national surveys on public perceptions with a focus on benefit perception (with

collaborators at Decision Research); a new survey on nano environmental risk perception; gender and race in public participation; traditional and new social medial framing; global collective action and civic engagement about nanotech; and development of responsible risk communication in conditions of uncertainty. Ex. of recent findings:

- Christian Beaudrie, Terre Satterfield, Milind Kandlikar, and Barbara Herr Harthorn. "Expert views on regulatory preparedness for managing the risks of nanotechnologies." *PLOS One*, in press, 2013

Novel cross-IRG initiatives draw on key UCSB strengths by targeting strategic nanotech application areas in solar and other renewable energy, environment, water, health, and food; spatial analysis and the global value chain; and equitable development. Collaborators at Duke University develop global value chain for nano businesses and firms and the nano workforce.

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 (4-5 positions each year), 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 (7-8 fellows per year). Both postdocs and graduate fellows experience outstanding outcomes, finding jobs in academia, research institutes, private foundations, policy institutes, and industry. In Summer 2013, the Center hosted its 8th 8-week Undergraduate Research Internship program, hosting 3 California community college students recruited through a partnership with the UCSB CNSI. This year's 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. Center researchers and education staff made over 150 presentations during the 2012-13 reporting year. At NanoDays 2013, the Center continued promoting dialogue between the general public and NSE researchers through general education about nanotechnology. Center PI Harthorn provided keynote addresses at the 2013 NNI Stakeholder Workshops in Jun and Sept 2013. Also in 2013, Co-PI Appelbaum co-hosted the First International Nanotechnology & Labor Workshop in Curitiba, Brazil.



International Collaborations are central to CNS-UCSB's ongoing work and include leading universities and institutes in Brazil, Canada, China, France, Mexico, S. Korea, Sweden, and the UK. CNS-UCSB is a founding member of the Society for the Study of Nanoscience and Emerging Technologies (S.NET). 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**