



Center for Nanotechnology in Society

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Nanoscale Science and Engineering Center at

University of California, Santa Barbara

Year 6 Annual Report

for the period

March 16, 2010 to March 15, 2011

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3. PROJECT SUMMARY

The Center addresses questions of nanotech-related societal change through research that encompasses three main 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** addresses global industrial policy and development of nanotechnology, with a particular focus on China, Japan & India and pathways to the use of nanotechnologies to spur equitable development; and **IRG-3: Nanotech Risk Perception and Social Response** conducts social research on formative nanotech risk and benefit perceptions in the US and abroad through a set of mixed qualitative and quantitative social science research methods aimed at studying the views and beliefs about emerging nanotechnologies by multiple stakeholders in the nano-enterprise. Cross-IRG projects on strategic topics (solar energy, spatial analysis), extend and integrate the three IRGs' work. The Center's three IRGs combine expertise in many fields: technology, innovation, culture, health, energy, global industrial development, gender and race, environment, space/location, and science and engineering. In combination, these efforts address a linked set of issues regarding the domestic US and global creation, development, commercialization, production, consumption, and control of specific kinds of nanoscale technologies. Important features of CNS' approach are participatory research and engagement with nanoscientists; a focus on specific nanotechnologies; comprehensive consideration of their applications in industries like electronics, energy, food, environmental, and health; and employment of a global framework for analysis. **IRG 3's** research develops methods for cross-national comparative study of modes of public participation. Collaborators in the CNS-UCSB are drawn in the US from UC Davis, the Chemical Heritage Foundation, Decision Research, Duke Univ., Lehigh Univ., Long Island Univ., Quinnipiac Univ., Rice Univ., SUNY Levin Institute, SUNY New Paltz, Univ. of Washington, and Univ. of Wisconsin, and internationally from Beijing Institute of Technology (China), Cardiff Univ. (UK), Univ. of British Columbia (Canada), Univ. of East Anglia (UK), and Univ. of Edinburgh (UK). CNS has served as a leader in the NSF Network for Nanotechnology in Society and is co-founder of the international scholarly organization S.NET, 2009. S.NET's 2nd annual meeting was in Sept/Oct 2010 in Germany, and CNS-UCSB and CNS-ASU will co-host the 3rd meeting in Tempe, AZ in Nov 2011. CNS is a research partner in the NSF/EPA UC Center for Environmental Implications of Nanotechnology.

Education and Public Engagement programs at CNS-UCSB aim to nurture an interdisciplinary community of nano scientists, social scientists, and educators who collaborate in CNS IRGs and achieve *broader impacts* through engagement of diverse audiences in dialogue about nano and society. CNS-UCSB provides 4-5 postdoctoral research scholar positions each year. Graduate Fellowships and researcher positions for social science and NSE enable them to participate jointly in CNS IRG research and education. A CNS 8-week intensive summer undergraduate internship program integrates California community college students into CNS activities. Through a year-round bi-weekly seminar program, a speakers series, conferences, visiting scholars, informal science education events for the public, electronic dissemination of a popular nano and society-related Weekly News Clips service to about 500, over a dozen public deliberation events with local community members in the US, Canada and UK, and accelerating outreach to key sectors of government and industry, the CNS maintains a solid following of campus, local, and national and international media, as well as interest by government, industry, NGOs, and the general public. In Jan 2010 and April 2010, CNS-UCSB convened two topical international specialist meetings on *nanotechnology risk perception* and *states of innovation*, each now generating new publications.

In 2010-11 CNS-UCSB continued substantial progress in research on pathways and impediments to socially and environmentally sustainable futures for nanotechnologies, producing 49 new publications in the past year, bringing total publications to 131 since inception 5.25 years ago, with another 45 in the publication stream, and making 50 presentations this year at academic venues. Harthorn and Pidgeon each gave testimony before national policymaking bodies in the US and UK, and CNS researchers made 66 presentations to key audiences in government, industry, NSE, and the public.

4A. LIST OF CENTER PARTICIPANTS*UCSB*

*Peter Alagona	Assistant Professor	History & Environmental Studies
David Awschalom	Professor, Director	Physics, CNSI
Richard Appelbaum	Professor	Sociology, Global & Int'l Studies
Edwina Barvosa	Assoc Professor	Chicana and Chicano Studies
Bruce Bimber	Professor	Political Science, Communication
Tim Cheng	Professor	Electrical and Computer Engineering
Brad Chmelka	Professor	Chemical Engineering
Julie Dilleuth	Education Coordinator/ Education Director	CNS
William Freudenburg	Professor	Environmental Studies
Fiona Goodchild	Education Director	CNSI
Michael Goodchild	Professor	Geography
Craig Hawker	Professor, Director	Chemical Engineering, Materials Research Laboratory & MRSEC
Barbara Herr Harthorn	Assoc Professor, Director	Feminist Studies, Anthropology, Sociology, CNS
Patricia Holden	Professor	Microbiology, Environment Sciences
Aashish Mehta	Assistant Professor	Global & Intl Studies, Econ
W. Patrick McCray	Professor	History of Science
John Mohr	Professor	Sociology
Meredith Murr	Director	UCSB Research Development
Christopher Newfield	Professor	English
David Seibold	Professor	Communication
Susan Stonich	Professor	Environmental Studies, Anthropology
*co-funding		

Sub-Award PIs

Frederick Block	<i>University of California, Davis</i> Professor, Emeritus	Sociology
Joseph Conti	<i>Univ of Wisconsin</i> , Asst. Prof	Sociology and Law
Sharon Friedman	<i>Lehigh University</i> , Professor	Journalism & Communication
Gary Gereffi	<i>Duke University</i> , Professor	Sociology, Global Value Chains
Timothy Lenoir	<i>Duke University</i> , Professor	History, Data visualization, Visual Studies
David Mowery	<i>UC Berkeley</i> , Professor	Economics, Business School
Cyrus Mody	<i>Rice University</i> , Asst Professor	History, Technology Studies
Nicholas Pidgeon	<i>Cardiff Univ, Wales, UK</i> , Professor	Social Psychology, Env. Risk
Theresa Satterfield	<i>Univ of British Columbia</i> , Assoc Prof	Culture, Risk & Environment
Paul Slovic	<i>Decision Research</i> , President	Psychology

Collaborators

Gerald Barnett	<i>Univ of Washington</i> , Director	University technology transfer
Daryl Boudreaux	<i>Boudreaux and Associates</i> , President	Commercialization

David Brock	<i>Chemical Heritage Foundation,</i>	History
Karl Bryant	Senior Research Fellow <i>SUNY New Paltz, Asst. Professor</i>	Sociology & Women's Studies
Cynthia Cannady	<i>Private sector, IPSEVA, lawyer</i>	International IP expert
Cong Cao	<i>SUNY Levin Institute, Res. Assoc</i>	Sociology, China
Hyungsub Choi	<i>Chemical Heritage Foundation</i>	History of Science
Meredith Conroy	<i>Occidental College,</i>	Politics
	Adjunct Assistant Professor	
Zhu Donghua	<i>Beijing Institute of Tech., Vice Dean</i>	Management and Economics
Brenda Egolf	<i>Lehigh University, Research Scientist</i>	Journalism
Guillermo Folodari	<i>Univ Autónoma de Zacatecas, Mexico</i>	Sociology
	Professor	
Robin Gregory	<i>Decision Research, Senior Researcher</i>	Economics, Psychology
Hillary Haldane	<i>Quinnipiac Univ, NY, Asst Prof</i>	Anthropology
Patrick Herron	<i>Duke University, Researcher</i>	Data mapping and Visualization
Jacqueline Isaacs	<i>Northeastern University, Professor</i>	Mech & Indust Engineering
Milind Kandlikar	<i>Univ of British Columbia, Assoc Prof</i>	Science Policy & Regulation
Howard Lovy	Consultant	Science writer
Rachel Parker	<i>Sci & Tech Policy Institute,</i>	Sociology
	Senior Research Associate	
Jennifer Rogers	<i>Long Island University, Asst Professor</i>	Sociology
Tee Rogers-Hayden	<i>Univ of East Anglia, UK, Fellow</i>	Environment, Deliberation
Suzanne Scotchmer	<i>UC Berkeley, Professor</i>	Economics
Edgar Zayago	<i>Univ Autónoma de Zacatecas, Mexico</i>	Development Studies
	Researcher	

UCSB Postdoctoral Scholars

Phillip McCarty	Sociology
Mikael Johansson	Social Anthropology
Yasuyuki Motoyama	City and Regional Planning
*Jennifer Rogers	Sociology
Matthew Eisler	History
*Gwen D'Arcangelis	Women's Studies
*Christine Shearer	Sociology
<i>* co-funding</i>	

Non-UCSB Postdoctoral Scholars

Adam Corner	<i>Cardiff University, UK</i>	Social Psychology
Stacey Frederick	<i>Duke University</i>	Textile Management
Anton Pitts	<i>University of British Columbia</i>	Risk Science
Tee Rogers-Hayden	<i>University of East Anglia, UK</i>	Environment, Public Participation
Elena Simakova	<i>Cornell University</i>	Science & Technology Studies
Joseph Summers	<i>Massachusetts Institute of Technology</i>	Physics, Engineering

Technical Staff

Jerry Macala *UC Santa Barbara, technical staff* Chemistry

CNS Graduate Fellows

Kasim Alimahomed	Communication
Karl Bryant	Sociology
Peter Burks	Chemistry/Biochemistry
Yiping Cao	Environmental Science
Meredith Conroy	Political Science
Joseph Conti	Sociology
Amanda Denes	Communication
Roger Eardley-Pryor	History
Cassandra Engeman	Sociology
Scott Ferguson	Mechanical Engineering
Alan Glennon	Geography
Summer Gray	Sociology
Hillary Haldane	Anthropology
Shannon Hanna	Environmental Science & Mgmt
Indy Hurt	Geography
Mary Ingram	Sociology
Erica Lively	Electrical Engineering
Gerald Macala	Chemistry
Tyronne Martin	Chemistry
Rachel Parker	Sociology
Alexis Ostrowski	Chemistry
Claron Ridge	Chemistry
Aaron Rowe	Chemistry
Christine Shearer	Sociology
Kim Stoltzfus	Communication
Joseph Summers	Electrical Engineering
David Weaver	Political Science
James Walsh	Sociology

CNS Graduate Student Researchers and Grad Student Research Assistants

***Lynn Baumgartner**, Environmental Science & Management

Jill Briggs, History

***Erin Calkins**, Chemistry & Biochemistry

***Ben Carr**, Environmental Science & Management

***Mary Collins**, Bren School

Lauren Copeland, Political Science

Rachel Cranfill, Linguistics Olivier Dufault, History

Roger Eardley-Pryor, History

***Cassandra Engeman**, Sociology

***Allison Fish**, Environmental Science & Management

Angus Forbes, Media Arts & Technology

Mario Guerrero, Political Science

Sarah Hartigan, Global Studies

Zach Horton, English

Pehr Hovey, Media Arts & Technology

Indy Hurt, Geography/GIS

*John Meyerhofer, Environmental Science & Management

Margaret Moody, Education

Moirá O'Neil, Sociology

Emily Tumpson Molina, Sociology

Adélaïde Veyre, Political Science

David Weaver, Sociology

***Lily Welty**, Asian American History and Mixed Race Studies

Silke Werth, East Asian Languages & Cultures

Qian Yang, East Asian Languages & Cultures

Fan Yuan-Yi, Media Arts & Technology

* *co-funding*

Non-UCSB Grad Student Researchers

Aaron McGuire, Duke University

Christian Beaudrie, University of British Columbia, Canada

Vincent Dorie, *Duke University*

Eric Giannella, *Stanford University*

Ryan Ong, *Duke University*

Stacey Frederick, *Duke University*

Laura DeVries, University of British Columbia, Canada

UCSB Undergrad Interns & Researchers:

Beatrice Balfour

William Bausman

Brian Billones

Brent Boone

Sean Bronston-Wilson

Sarah Bunch

Lamar Bush

Jason Cannon

Staci Chirchick

Adélaïde Chopard

Andi Docktor

Josefina Garong

Simone Jackson

Gary Haddow

Katherine He

Jon Lo Kim Lin

Christian McCusker

Javier Martinez

Dayna Meyer

Carlos Perez

Srijay Rajan

Samantha Rohman

Olivia Russell

Nicholas Santos

Sarah Schultz

Ryan Shapiro
 Andrea Tran
 Nicole Tyler
Julie Whirlow
Sabrina Wu
Joy Yang
Maria Yopez
 Guanglei Zhang

Non-UCSB Undergraduate Researcher
Sean Becker, Univ of Wisconsin-Madison

CNS staff
Shawn Barcelona
 Jaquelyn Bernuy
Sage Briggs
 Marisol Cedillo Dougherty
Lea Danilewsky
 Eric Davila
 Anna Davison
 Justin Dodds
Randall Ehren
Barbara Gilkes
Stacy Rebich Hespanha
 Emily Kang
Monica Koegler-Blaha
Brendy Lim
 Michelle Olofson
Lesley Strabel, Cardiff University
 Jessica Suseno
 Valerie Walston

Participants affiliated, not receiving Center support:

UCSB

Kevin Almeroth	Professor	Computer Science
James Blascovich	Professor	Virtual Environments, Psychology
Daniel Blumenthal	Professor	Electrical & Computer Engineering
David Clarke	Professor	Materials, Mechanical Engineering
Jennifer Earl	Associate Professor	Sociology
Andrew Flanagin	Professor	Communication
Arthur Gossard	Professor	Materials, ECE
Anita Guerrini	Professor	History & Environmental Studies
Elisabeth Gwinn	Professor	Physics
Stephanie Hampton	Deputy Director	Center for Ecol Analysis & Synthesis
Evelyn Hu	Professor	Materials & CNSI
Miriam Metzger	Associate Professor	Communication

Umesh Mishra	Professor	Electrical & Computer Engineering
Laury Oaks	Associate Professor	Anthropology, Feminist Studies
Jim Reichman	Professor, Director	NCEAS; Ecology
Mark Rodwell	Professor, Director	Electrical & Computer Engineering, NNIN
Suh Sangwon	Associate Professor	Bren School
Ram Seshadri	Professor	Materials, Chemistry & Biochemistry
Hyongsok Soh	Associate Professor	Env Engineering
Nicola Spaldin	Professor	Materials
Matthew Tirrell	Professor, Dean	Chemical Engineering & Materials, College of Engineering
Win Van Dam	Assistant Professor	Computer Science

Other Institutions

Robert Ackland	<i>Australian Nat'l Univ, Res.faculty</i>	Economics
Francesca Bray	<i>Edinburgh Univ, UK, Professor</i>	Gender & Technology, China
Magali Delmas	<i>UCLA, Associate Professor</i>	Corporate Environmental Mgmt.
Vladi Finotto	<i>Venice Int'l Univ, IT Researcher</i>	Economics
Ann Johnson	<i>University of South Carolina, Associate Professor</i>	History of Science and Tech, Modern Europe
Stéphanie Lacour	<i>Centre National de la Recherche Scientifique, France, Research Fellow</i>	IP, Law & New Technologies
Ephraim Massawe	<i>Southeastern Louisiana University, Assistant Professor</i>	Computer Science & Industrial Technology
Stefano Micella	<i>Venice Int'l Univ, Director</i>	Technologies in Distributed Systems
Mara Mills	<i>NYU, Assistant Professor</i>	Media, Culture & Communication
André Nel	<i>UCLA, Professor, Physician, Director</i>	UCLA Med School, UCLA CEIN
Joseph November	<i>University of South Carolina, Assistant Professor</i>	History
Mathiu O'Neil	<i>Australian Nat'l Univ, Postdoc</i>	Computer science, sociology
Ismael Rafols	<i>Sussex University, Researcher</i>	Science Policy
Shyama Ramani	<i>INRA & Ecole Polytechnique, Paris, Researcher</i>	Development Economics
Alain Rieu	<i>University Lyon 3, France, Professor</i>	Philosophy
Kalpana Sastry	<i>Natl Academy of Agricultural Research Management, India, Principal Scientist & Head</i>	Agriculture

Graduate Student Collaborator

Brittany Shields, University of Pennsylvania

Nanotechnology in Society Network PIs:

David Guston, CNS-ASU

Davis Baird, University of South Carolina

Richard Freeman, Harvard University

Lynne Zucker, UCLA

4B. EXTERNAL ADVISORY BOARD

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), [Board Co-Chair](#)

Ann Bostrom, Professor and Dean in School of Public Policy at University of Washington, Seattle, [Board Co-Chair](#)

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

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

Thomas Kalil, UC Berkeley, currently a team Lead of the Executive Office of the President, Co-Lead of the White House OSTP Review Team, and a member of the Technology, Innovation & Government Reform Policy Working Group in the Obama administration, [Board Chair Emeritus](#), 2007-2008

Julia Moore, Director of Research, Pew Health Group, Pew Charitable Trusts; former Deputy Director of Foresight and Governance Project at the Woodrow Wilson International Center for Scholars, [Board Co-Chair Emeritus](#)

4C. LIST OF PARTICIPATING ACADEMIC INSTITUTIONS

Allan Hancock Community College
Arizona State University
Australian National University, Canberra, Australia
Beijing Institute of Technology
Cal Poly San Luis Obispo
Cardiff University, Wales, UK
Centre National de la Recherche Scientifique (CNRS), France
Cornell University
Cuesta Community College
Duke University
Ecole Polytechnique, Paris
Harvard University
Howard University
Jackson State University
Lehigh University
Long Island University
Massachusetts Institute of Technology
Michigan State University
Moorpark College
Natl Academy of Agricultural Research Management, India
New York University
Northeastern University
Nottingham University, UK
Occidental College
Oxnard Community College
Quinnipiac University
Rice University
Santa Barbara City College
Southeastern Louisiana University
SUNY Levin Institute
SUNY New Paltz
Sussex University
Universidad Autónoma de Zacatecas, Mexico
Université de Lyon 2
Université de Lyon 3
University of British Columbia, Vancouver, Canada
University of California, Berkeley
University of California, Davis
University of California, Los Angeles
University of California, Santa Cruz
University of East Anglia, Norwich, UK
University of Edinburgh, Scotland, UK
University of Pennsylvania
University of South Carolina
University of Southern Florida
University of Washington
University of Wisconsin-Madison
Venice International University, Venice, Italy
Ventura College

4D. LIST OF PARTICIPATING NON-ACADEMIC INSTITUTIONS

American Bar Foundation
American Institute of Physics
Boudreaux and Associates
Chemical Heritage Foundation
Cynthia Cannady Legal Services
Decision Research
Environmental Defense Fund
International Council on Nanotechnology (ICON)-Rice University
International Risk Governance Council (Switzerland)
Knowledge Networks
Meridian Institute
Nanoholdings, LLC (NY)
Nanoscale Informal Science Education (NISE) network
Northwest Survey and Data Services
Santa Barbara Museum of Natural History
Woodrow Wilson International Center, Project on Emerging Nanotechnologies

Table 1: Quantifiable Outputs						
Outputs	Reporting Year -4	Reporting Year -3	Reporting Year -2	Reporting Year -1	Reporting Year	Total
Publications Resulted From NSEC Support						
In Peer-Reviewed Technical Journals	0	11	31	24	24	90
Chapters/sections in books/books (prev yr totals not provided)					61	
Other					9	
TOTAL PUBLICATIONS (Prev yr totals not provided)					94	
With Multiple Authors:						
Multiple Authors: Co-Authored with NSEC Faculty	0	9	20	18	36	83
	0	9	20	18	33	80
NSEC Technology Transfer						
Inventions Disclosed	0	0	0	0	0	0
Patents Filed	0	0	0	0	0	0
Patents Awarded	0	0	0	0	0	0
Patents Licensed	0	0	0	0	0	0
Software Licensed	0	0	0	0	0	0
Spin-off Companies Started(if applicable)	0	0	0	0	0	0
Degrees to NSEC Students						
Bachelor's Degrees Granted	0	0	0	0	0	0
Master's Degrees Granted	0	2	0	0	5	7
Doctoral Degrees Granted	0	3	2	1	8	14
NSEC Graduates Hired by						
Industry:	0	0	0	0	0	0
NSEC Participating Firms	0	0	0	0	0	0
Other U.S. Firms	0	0	0	0	0	0
Government	0	0	0	0	1	0
Academic Institutions	0	4	1	0	5	5
Other	0	0	1	1	1	2
Unknown	0	0	0	0	0	0
NSEC Influence on Curriculum (if applicable)						
New Courses Based on NSEC Research	0	4	1	0	8	13
Courses Modified to Include NSEC Research	0	6	8	11	10	35
New Textbooks Based on NSEC Research	0	0	0	0	2	2
Free-Standing Course Modules or Instructional CDs	0	0	0	0	0	0
New Full Degree Programs	0	0	0	0	0	0
New Degree Minors or Minor Emphases	0	2	0	0	0	2
New Certificate	0	0	0	0	0	0
Information Dissemination/Educational Outreach						
Workshops, Short Courses to Industry	0	2	0	1	6	9
Workshops, Short Courses to Others	0	0	1	1	15	17
Seminars, Colloquia, etc.	0	75	0	14 [†]	137	353
World Wide Web courses	0	0	0	0	1	1

6. MISSION AND BROADER IMPACTS

Nanotechnology Origins, Innovations, and Perceptions in a Global Society

The global vision for nanotechnology to mature into a transformative technology that furthers social as well as economic aims depends on an array of complex and interconnected factors situated within a rapidly changing international economic, political, and cultural environment. The NSF Center for Nanotechnology in Society at UCSB pursues an integrated portfolio of interdisciplinary societal research on the challenges to the successful, responsible development of nanotechnology in the US, Europe, Asia and other regions at a time of sustained technological innovation. The Center incorporates education for a new generation of social science and nanoscience professionals as it fosters research on the innovation and development systems for nanoscale technoscience across space and time, in conjunction with analysis of the societal meanings attributed to such emergent technologies by diverse stakeholders. CNS-UCSB contributes to responsible development by engaging with those key stakeholders: scientists, toxicologists, policymakers and regulators, EH&S personnel, the nanomaterials industry, public and public interest groups, and journalists, in the global North and South.

Broader Impact

CNS's education and outreach programs, which are central to its mission, include a diverse range of students and participants. The Center provides novel interdisciplinary educational opportunities for a new generation of social science, humanities and nanoscience professionals via graduate fellowships and research assistantships (16 social science/humanities fellows; 11 NSE fellows to date); graduate research assistantships (29 at UCSB; 8 w/ external collaborators), undergraduate summer research internships to regional community college students (2 in the past year, 12 since inception) and UCSB undergrads (2 in 2010, 12 total since 2006) who are mentored by UCSB graduate students (23 mentorships to date), and 1-3 interdisciplinary social science/humanities postdocs per year since 2007-08 (6 in 2010-11, 3 of them co-funded). CNS convenes a year-round graduate seminar for credit that includes scholarly discussion, professional training and development, research colloquia, and other activities. CNS integrates content based on Center research into courses for undergraduate and graduate students in science and technology studies, and plans to prepare educational modules for introduction of CNS-UCSB research materials into the NSE undergrad science and engineering curriculum, community college science and social science curricula, and for California high school teachers to use in social science and science classes.

CNS aims to disseminate both technological and social scientific findings related to nanotechnology in society to the wider public and to facilitate public participation in the nanotechnological enterprise through public engagement in dialogue with academic researchers from diverse disciplines (in 2010-2011 held 1 Nano-Meeter, and 2 annual NanoDays with nearly 700 adults and children). CNS-UCSB commits significant resources to conferences and workshops for diverse audiences, alternating smaller, more specialized meetings for educators (Nano societal implications education 2008) and researchers (Nanotech risk perception 2010, Nanotech innovation systems 2010) with larger-scale international conferences and workshops (large international conference on Nanotechnology Equitable Global Development in Nov 2009 in Washington DC, another on Nano Occupational Health and Safety in Nov 2007 at UCSB). In Nov 2011 CNS-UCSB will serve as co-host of the 3rd international meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET). In addition to its co-founding role in S.NET, CNS serves as a key connection hub in the growing nano in society network, via speaker series, short- and medium-term visiting scholars, and as a dissemination point for research results (as requested by Chemical Heritage Foundation, UC Center for the

Environmental Implications of Nanotechnology, and others). Outreach to still wider publics and interested parties takes place via electronic forms such as our popular “Weekly News Clips,” our blog, podcasts of interviews with researchers, media briefings, and anticipated new media methods in the future. The CNS also engages and informs policymakers and governmental agencies (e.g., Barbara Herr Harthorn to the NNI and California Council on Science & Technology in Jan 2010, to PCAST/OSTP in Feb 2010, to the NNI and to NNCO in Mar 2010, to NIOSH in Jul 2010; Nick Pidgeon to the UK House of Commons Science and Technology Committee in Jan 2010 and on an ongoing basis to the UK House of Lords; Patrick McCray via op ed pieces in the influential blog, *Science Progress*). CNS researchers contribute to the UC CEIN empirical knowledge of the public, emerging views of nanotech, and past risk controversies for use in developing risk reduction and risk management advice to regulators. Results of CNS research are being disseminated to wider audiences via traditional media as well as through concerted efforts to use new media (e.g., posts to the prominent blog, *Science Progress*, and through contributions to sources like *AzoNano* and *ChemE* that reach a wide array of industry, policy, and academic audiences).

Synthesis of CNS-UCSB research is culminating in 4 volumes currently in press or in late stages of preparation: a book for a wider public audience developed from the 2009 NanoEquity conference, *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?*, edited by Parker and Appelbaum, forthcoming from Routledge, 2011/2012; *The Social Life of Nanotechnology*, edited by Harthorn & Mohr, contracted by Routledge, draws from and integrates all three research groups’ research in a social science analysis of innovation, public perception, and governance; a planned special issue of the leading journal, *Risk Analysis*, from the IRG 3 risk perception specialist meeting in Jan 2010 and edited by IRG 3 leaders Pidgeon, Harthorn & Satterfield; and *Can Rich Countries Still Invent?*, edited by Newfield and Boudreaux, developed from the *States of Innovation* international conference in Lyon, France in April 2010. CNS-UCSB also plans as summative activities development of a series of policy briefs to extend the implications of the maturing research mission. CNS’ distinguished National Advisory Board allows strategic consultation with leaders of stakeholder constituencies at all phases of research and dissemination.



Institutions, Energy, and Nanotechnology

Questions

1. Department of Energy involvement in nanotechnology as a science policy initiative and material practice
2. Has NNI influenced management and conduct of research at DOE? If so, how?
3. Has nanoscale science, engineering, and technology (NSET) at DOE contributed to development of sustainable energy technologies? Economic growth? Risk issue here is financial

Methods

1. Analysis of Smalley Papers at Rice University and Chemical Heritage Foundation
2. Interviews or discussions with 6 researchers and 2 program managers involved in DOE energy and/or power source-related NSET (more planned)
3. Analysis of official DOE documents and public statement of DOE officials

Preliminary Findings

- The term 'nanotechnology' introduced in DOE's Office of Basic Energy Sciences (OBES) as an expression of science policy discourse in late 1990s
- Discourse of revolutionary applied science was developed by OBES-linked condensed matter and materials physics community at a time when state-sponsored programs of basic research under strong political pressure to justify utility, DOE user facilities threatened by budget cuts
- Over the course of 1999, nanotechnology chosen by OBES as label for this discourse; condensed matter and materials physics/complex systems became alternatively known as nanoscale science, engineering, and technology, or nanotechnology
- OBES promoted nanoscale science research centers as dual-use industrial/academic R&D user facilities; five were built between 2000-2008, but rationale for industrial users unclear, legacy uncertain

Promoting and (re)labeling a discourse of revolutionary applied science

In 1997, the National Academy Press published a pamphlet (right) by the Committee on Condensed-Matter and Materials Physics promoting the discipline as central to industrial growth. The Committee suggested that bolstering the field and DOE high-energy infrastructure would create a dual-use capacity that could serve industry. Some

15,000 copies of the pamphlet were produced and distributed, including one to every high school in the U.S. The cover featured a scanning-tunneling microscope image of a 'quantum corral' of 48 atoms depicting the wave nature of electrons. This would become a canonical representation of nanotechnology (National Academy Press, 1997)



Nanotechnology and Bibliometry

Previous bibliometric research indicates that the U.S. leads the field of nanotechnology. But such analyses do not account for productivity. When integrating the number of researchers and investment, the U.S. lags behind other countries (Motoyama and Eisler, *TFSC*, 2011)

Matthew N. Eisler, "Shifting Molecules, Mixing Metaphors: A Short History of Science, Technology, and Energy," forthcoming in *Science Progress*; "Saving the Phenomenon: Boundaries of Science Communication, the Department of Energy, and Discourses of Revolutionary Applied Science in an Era of Science Reform," in preparation for submission to *Minerva*; Yasuyuki Motoyama and Matthew N. Eisler, "Bibliometry and Nanotechnology: A Meta Analysis," forthcoming in *Technological Forecasting and Social Change*



Observing Regional Divergence in China: Spatial Analysis of Nanotechnology Patents

Do centers of nanotechnology diffuse geographically or become more concentrated in key regions over time?

Regional convergence theory (e.g., Co 2002) suggests that nanotech patents will diffuse over time, such that regions become increasingly similar with regard to patent production, while *regional divergence theory* (e.g., O'Huallachain 1999) suggests increased spatial clustering of patents into dominant regions. The focus of this case study is to identify which processes are dominant.

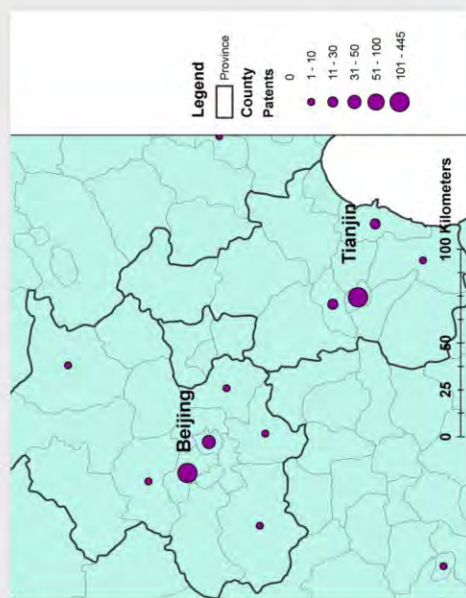
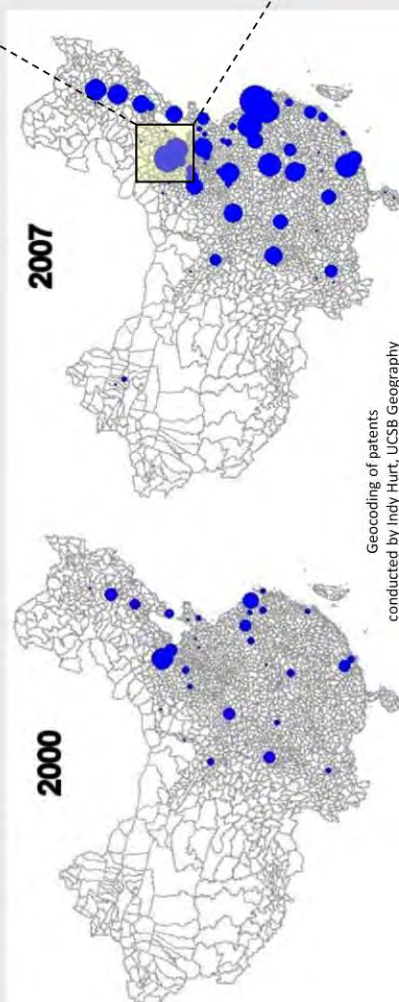
Productive Chinese nanotech centers have been heavily concentrated in the Beijing and Shanghai areas over the past decade due to substantial public funding directed to a few key institutions.

• As predicted by regional divergence theory, geographic concentration is persistent over time.
 • A closer observation in the Beijing area and spatial analysis suggest that the clustering is most captured at the scale of 20-25km (13-17mi).

These findings suggest that **geographic spillovers of nanotechnology take place at a small scale** (substantially smaller than U.S. states). If diffusion of nanotech innovation is desired, policymakers should develop strategies to promote inter-regional transfer, possibly including refinement of the research grant distribution.

findings & implications

- ### methods
- Extracted data from Chinese State Intellectual Property Office using 15 nanotechnology-related keywords
 - Geocoded postal codes and joined with province and county boundaries
 - Employed Gini coefficient & Moran's I to test spatial clustering and changes over time (2000-07, each year)



Motoyama, Yasuyuki and Richard Appelbaum. "Observing Regional Divergence of Chinese Nanotechnology Centers." In preparation for *Regional Science Policy and Practice*



The Contributions of Foreign-Born Scientists to U.S. Nanotechnology Innovation

What is the role of foreign-born scientists and engineers in U.S. nanoscience innovation?

While scholarship has documented the role of non-citizens in innovation concerning information technology and biotechnology, comparable studies on nanotechnology are conspicuously absent.

This study examines the authors of the top-1% most highly-cited articles on nanotechnology by U.S. scientists and engineers between 1999-2009.

- Most highly-cited articles identified using bibliometric methods.
- Nationality of authors (both corresponding and non-corresponding) gathered through biographic resources (*American Men and Women of Science*). At present, only data on corresponding authors has been analyzed. Nationality of remaining authors will be determined through survey conducted in spring 2011.
- Data benchmarked against the prevalence of the foreign born in the American scientific labor force and general population (statistical significance determined using Chi-square and two-tailed binomial test) to determine significance.

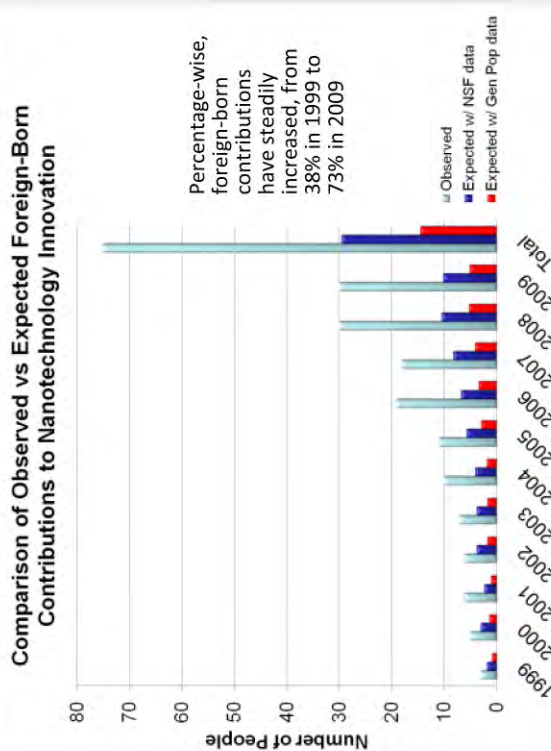
Methods

Results

- Prevalence of the foreign-born significantly exceeds that of the general population ($p < .05$ for all years, $p < .01$ for 2005-2009) and of the U.S. scientific community as a whole.
- China, India and Germany all made significant contributions.

These findings point to the **significance of non-native researchers in promoting U.S. nanotechnology innovation**. The data indicate **significant internal globalization** of the American scientific and engineering communities.

Figure 1



Top 4 Countries by Number of Corresponding Authors

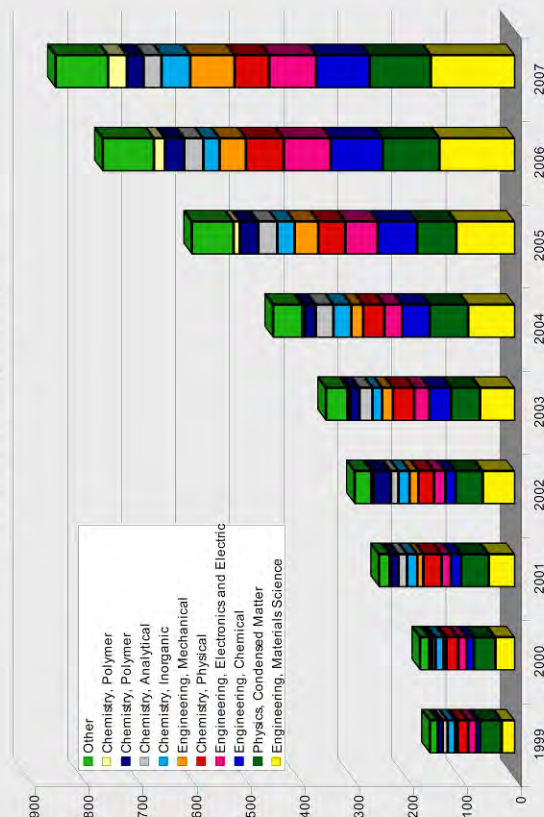
United States of America → 47 Scientists
 China → 21 Scientists
 India → 8 Scientists
 Germany → 5 Scientists

Walsh, James, Richard Appelbaum, and Sriyay Rajan. 2011. "The Contributions of Foreign-born Scientists to Nanotechnology Innovation 1999-2009." *Manuscript in Preparation*.



Nanotechnology Doctoral Production 1999-2009

Nano PhD Growth by Subdiscipline



- By providing a link between the established research community and future scholarly work, the profile of recent graduates and junior researchers intimately structures the trajectory of research and innovation and is central in the intergenerational transmission of knowledge.
- Despite its potential for mapping quantitative and qualitative shifts in the emerging scientific community, studies of nanotechnology have neglected PhD production in favor of patents, publications and other data.

Introduction

- All dissertations published on nanotechnology between 1999-2009 retrieved from the Proquest/UMI dissertation database.

- Dissertations identified using bibliometric methods.

- Data was coded by year, department, university and geographic location to study trends in the disciplinary, institutional and spatial distribution of recent doctorate production. Our initial findings related to field of study are provided to the right.

Data

When completed, our study promises to enhance the monitoring and evaluation of research capacities by academics and policymakers. Specifically our data can be utilized by governments, firms and universities to augment strategies for future research planning and capacity building- both of which are increasingly instrumental in remaining globally competitive in cutting-edge sectors.

Implications

Walsh, James, Claron Ridge, and Richard Appelbaum. 2011. "Innovators in the Pipeline: Nanotechnology Doctoral Production 1999-2009." *Manuscript in preparation*.



Effect of Positive & Negative Comparisons on Attitudes Toward Technology

Problem. Risks and benefits of different technologies are often compared to one another. Comparisons can have unexpected consequences, however. Comparison may trigger anchoring effect, in which people unconsciously associate two objects as being similar despite the intention of the comparison to create contrast. Or, comparisons can trigger a sense of contrast, pushing beliefs about the unknown risk away from the known one.

In this study, based on an experimental survey with 809 subjects, we examine how comparisons among technologies shape peoples' attitudes.

Question 1. Do comparisons with landline phones or X-ray radiation affect beliefs about cell phone safety?

Result: Subjects who are first asked to compare cell phones with landline phones believe cell phones are more dangerous than people not making a comparison. Comparison with X-rays has no effect.

Question 2. Do comparisons with further reliance on foreign oil or wind & solar power affect attitudes toward nano fuel additives?

Result: Subjects who compare with wind & solar power are less positive toward nano fuel additives than people not asked to compare; comparison with foreign oil has no effect.

Question 3. Do comparisons with eating organic food or eating fast food affect attitudes toward nano-packaging for food?

Result: There are no differences between subjects in the reference and treatment conditions.

Interpretation. Some comparisons among technologies are subject to **contrast effects**, in which a comparison with a benign, familiar object makes an unknown technology look worse than when no comparison is made.

This effect is:

- contingent on the specific technologies;
- stronger in less ideological people;
- and stronger in more cognitively sophisticated people.

Bimber, Bruce, Meredith Conroy, and Erica Lively. (2011). "Comparison Effects in Judgment about Public Issues," under review.

Target Issue	Condition 1		Condition 2		Ref. Condition Mean/Std. Dev.
	Positive Comparison	Mean Diff.	Negative Comparison	Mean Diff.	
Nano Food Packaging	Organic Food	3.39 -0.01	Fast Food	3.42 -0.03	3.38 (0.99)
Nano Fuel Additive	Wind & Solar	3.09 -0.20*	Foreign Oil	2.79 0.10	2.89 (0.83)
Cell Phones	Landline Phone	3.03 -0.38*	Radiation	2.79 -0.13	2.65 (0.97)

*= p < .01



Gender, Race & Equitable Participation: Engaging Diversity in Public Deliberation

Methods

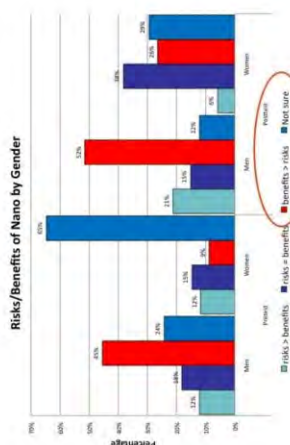
6 Calif. Deliberative workshops 2009

Diversity ~ reflect US population

- Small groups, 4.5 hours, single session
- Pre-/Posttests—risk & benefit perceptions

Sequence

- Discussion of cultural domains (energy, environment & technology)
- Introduce nanotechnologies
- Self select articles to read
- World Cafés (small groups)
- Final dialogue



Main Findings: Bases for Gendered Risk Perception in Social Risk and Technological Uncertainty

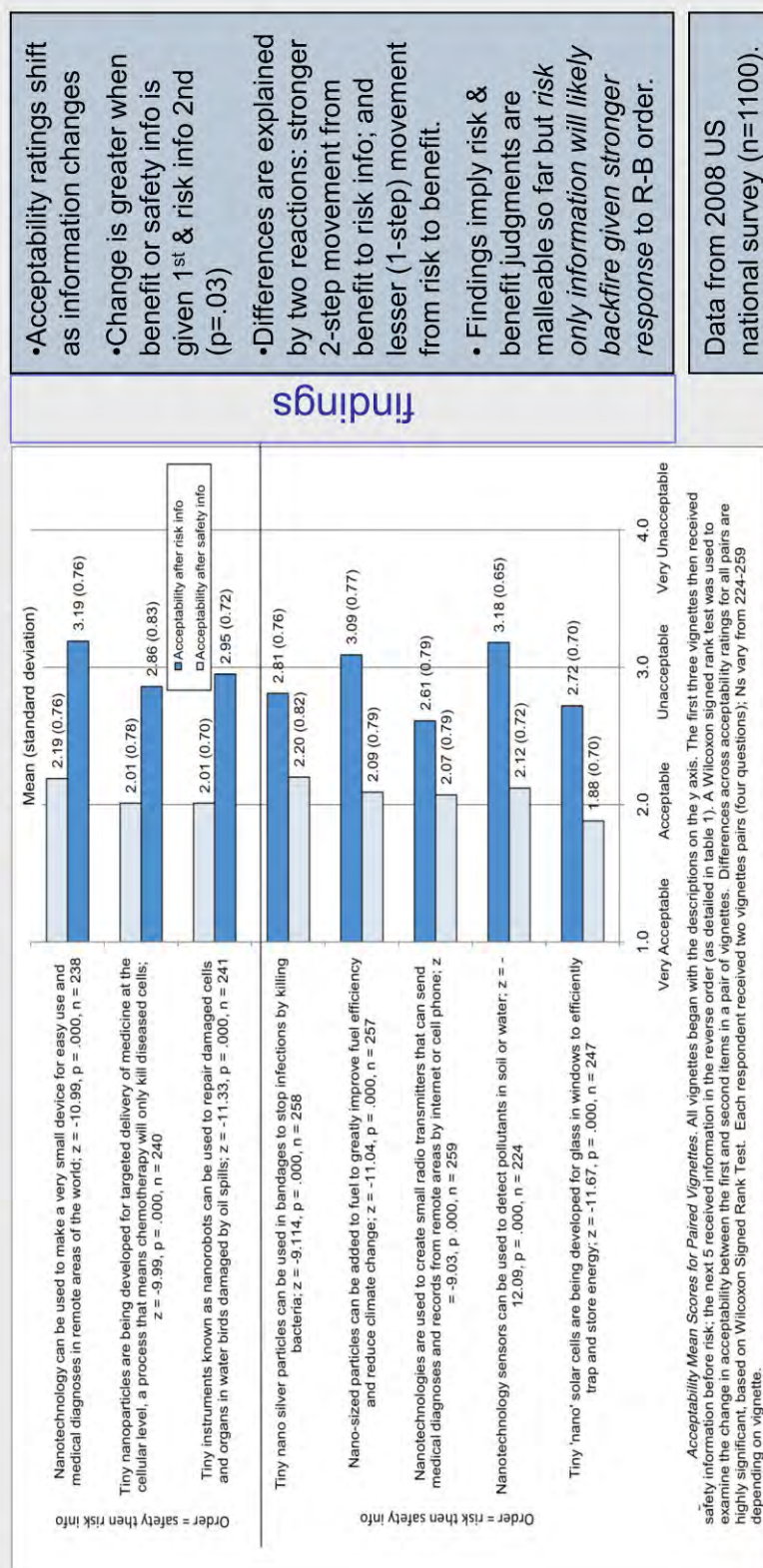
- **Gender and race/ethnicity differences** strong, with women highly uncertain at pretest; deliberation participation has much stronger effect on women's views than men's
- **Fairness** is a key dimension in forming risk views—re: distribution of risks and benefits; re: procedures and opportunities for participation
- **Mistrust** of corporations/industry greatest source of uncertainty and ambivalence; spillover on others for collusion with industry
- **Economic conditions** and **lack of job creation** also factors
- **Scientific uncertainty** about risks, calls for labeling and precautionary principle



Harthorn, Barbara Herr (UCSB), Jennifer R. Rogers (ULI), Christine Shearer (UCSB), & Tyrone Martin (UCSB). 2011. Chapters in press in: *Debating Science* (2011) and *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development*, eds. Richard P. Appelbaum & Rachel Parker. Routledge. Under review in *Social Life of Nanotechnology*.



Early Warnings for Nanotechnology Risk Communication: Benefit Tenacity or Risk Betrayal?



Satterfield, Theresa, Joseph Conti, Barbara Herr Harthorn, & Milind Kandlikar. Dec 2010. "Early Warnings for Nanotechnology Risk Communication: Benefit Tenacity or Risk Betrayal?" under review, *Environmental Science and Technology*.



Vulnerability and Social Justice as Factors in Emergent US Nanotechnology Risk Perceptions

Problem: How will information about nanotechnology research and development be encountered and perceived given variations in the attributes of information, and given the attitudes and social experience of perceivers (whether they see the world as just, or not; and whether they experience themselves as vulnerable in the world, or not)? Two experiments in risk messaging were conducted to assess how new technologies are taken up by social groups that vary by experiences of vulnerability and attitudes towards environmental justice.

Method: an experimental U.S. national telephone survey (N= 1,100) conducted in 2008. Vulnerability and Environmental Justice scales constructed from six survey items.

Findings:

1. Comparative analyses of different examples of nanotechnology applications demonstrated heightened ambivalence across acceptability when risk versus benefit information was provided with application descriptions (described in short vignettes as compared to the general category "nanotechnology," absent of risk or benefit information).
2. Experimental narrative analyses, using longer more comprehensive descriptive passages, show how assessments of risks and benefits are tied to the systematically manipulated psychometric qualities of the application (its invasiveness and controllability), risk messaging from scientists, and the social implications of the technology as concerns justice.

Comparative Analysis of Nanotechnology Applications with Risk and Safety Correctives

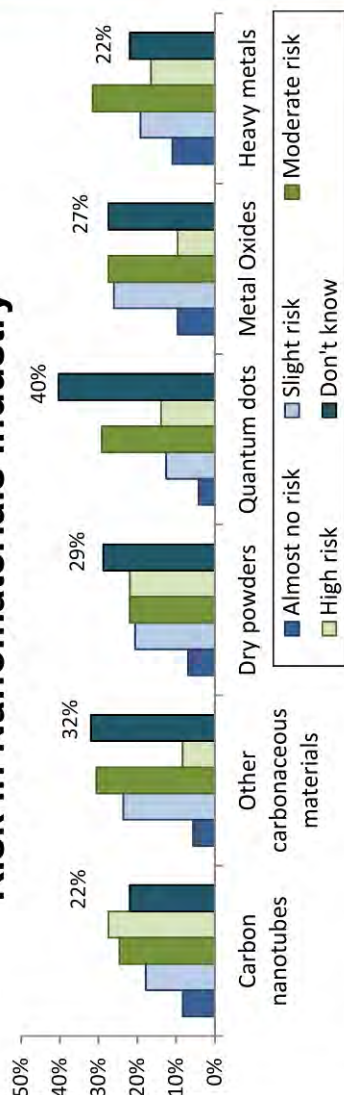
	NANOTECHNOLOGY SENSORS CAN BE USED TO DETECT POLLUTANTS IN SOIL AND WATER. HOWEVER, EXPERTS WORRY THAT THESE TINY SENSORS WILL DEGRADE OVER TIME BECOMING TOXIC TO FISH OR HUMANS WHO USE OR DRINK THE WATER.	TINY NANO SILVER PARTICLES CAN BE USED IN BANDAGES TO STOP INFECTIONS BY KILLING BACTERIA. BUT NANOSILVER IS CONSIDERED A POLLUTANT; IF IT TURNS UP IN OUR RIVERS OR OCEANS, FISH AND OTHER MARINE LIFE MAY BE WIDELY HARMED.	TINY NANOTECHNOLOGIES ARE USED TO CREATE SMALL RADIO TRANSMITTERS THAT CAN SEND MEDICAL DIAGNOSES AND RECORDS FROM REMOTE AREAS BY INTERNET OR CELL PHONE. AS THE INFORMATION IS SENT, HOWEVER, LEAKS IN PRIVACY MAY BE UNSTOPPABLE OR IRREVERSIBLE.	TINY INSTRUMENTS KNOWN AS NANOROBOTS CAN BE USED TO REPAIR DAMAGED CELLS AND ORGANS IN WATER BIRDS DAMAGED BY OIL SPILLS. THIS NEW TECHNOLOGY AND HOW TO CONTROL IT IS NOW WELL UNDERSTOOD BY WITH LIMITED OR NO MEDICAL SERVICES EXIST.	TINY NANOPARTICLES ARE BEING DEVELOPED FOR TARGETED DELIVERY OF MEDICINE AT THE CELLULAR LEVEL. A REMOTE AREA OF CHEMOTHERAPY WILL ONLY KILL DISEASED CELLS. THIS NEW TECHNOLOGY WILL BE AVAILABLE FOR THE POOR OR THOSE AREAS WHERE FEW HEALTHCARE SERVICES EXIST.
Vulnerability	-.21** (.07)	-.02 (.06)	-.24*** (.06)	-.19** (.07)	-.08 (.06)
Environmental Justice	-.21** (.07)	-.24*** (.06)	-.003 (.06)	-.03 (.07)	-.10 (.07)
Pseudo R ² (Nagelkerke)	.09	.07	.08	.03	.07
Model X ²	223.49	294.71	322.80	261.01	305.35
-2LL	.000	.000	.000	.03	0.48
					269.8
					.002

Participants (four sub-samples of approximately N = 275) were asked to provide ratings of acceptability for a range of specific nano-applications, each described in short vignette form. All vignettes began with a statement of the purpose of the technology and its benefits; three of these were accompanied by clear safety messages, and three were followed by counterpart risk message. For vulnerability and environmental justice, a high number indicates strong disagreement. Standard errors are in parentheses. * = p < .05; ** = p < .01; *** = p < .001

Conti, Joseph., Teresa Satterfield, Barbara Herr Harthorn. 2011. "Vulnerability and Social Justice as Factors in Emergent US Nanotechnology Risk Perceptions." Under Review at *Risk Analysis*.



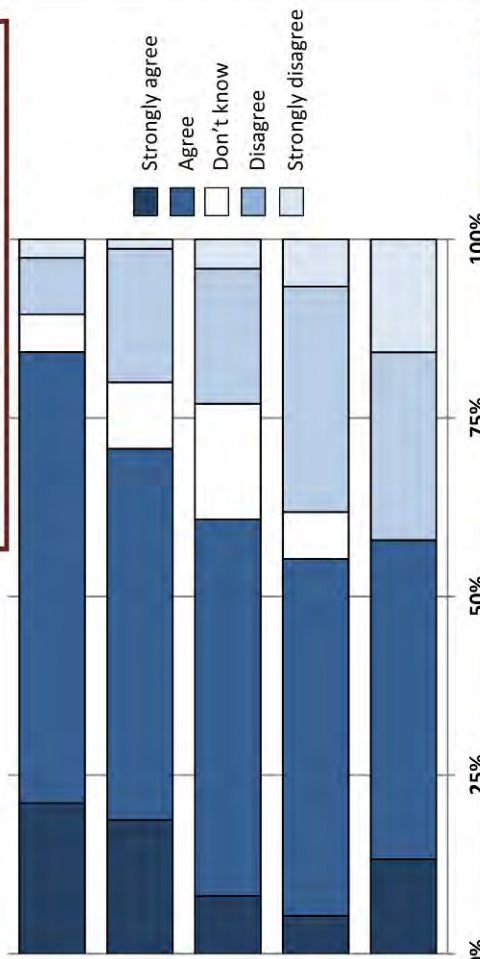
International Survey of EH&S & Perceived Risk in Nanomaterials Industry



Key findings → need for regulation, education

- Only 46% of participants reported having a nano-specific EHS program.
- More (61%) cited "lack of information" as an impediment to implementing nano-specific EHS practices than any other obstacle.
- Participants reported high levels of uncertainty about ENM risks
- **Despite reported lack of information and uncertainty about ENM risk, a majority of participants believes 'industry knows best'**

1. It is reasonable to assume that industries working with nanomaterials will adapt or alter their safe-handling practices when new hazards are discovered.
2. Businesses are better informed about their own workplace safety needs than are government agencies.
3. Industries working with nanomaterials can be trusted to regulate the safe-handling of these materials.
4. Voluntary reporting approaches for risk management are effective for protecting human health and the environment.
5. Employees are ultimately responsible for their own safety at work.



Engeman, Baumgartner, Carr, Fish, Meyerhofer, Holden, & Harthorn 2011.
In Progress.

NSF: EF-0830117
NSF: SES-0531184
NSF: SES-0938099





International Technology Innovation Workshop

The workshop was convened to ask:

- Where does the innovation model currently stand?
- Are variants in Europe and Asia more successful?
- Can a better model be produced?

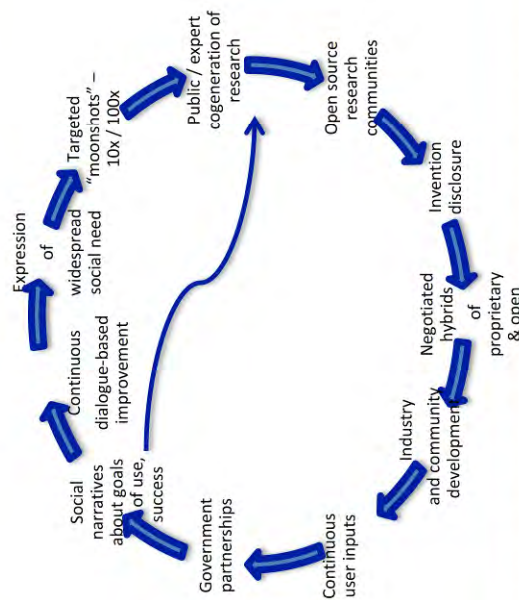
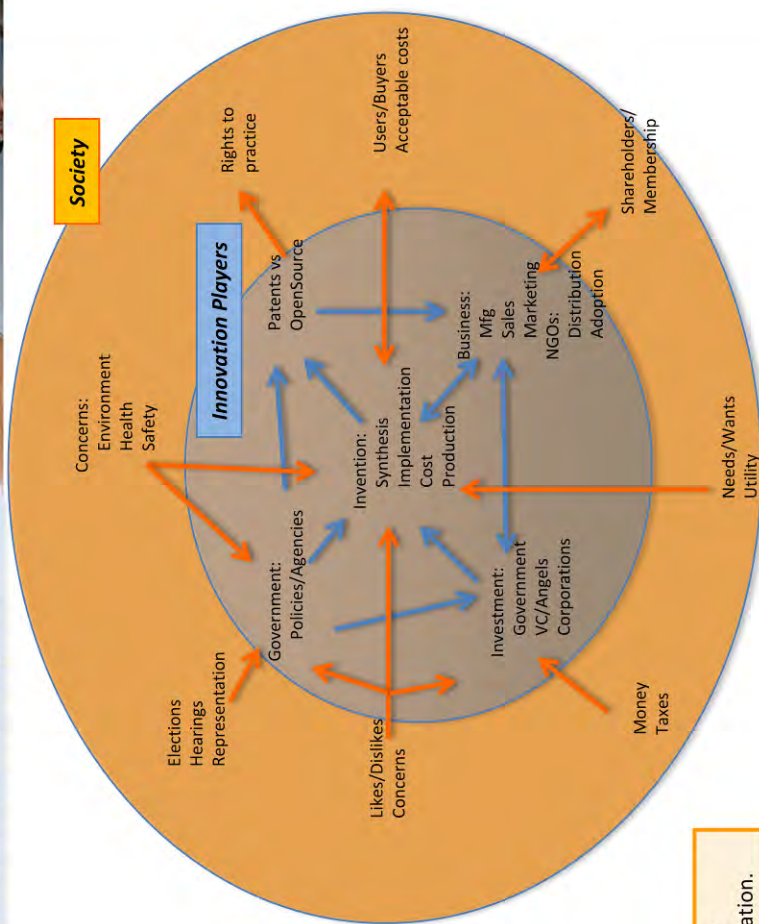
Two interim versions of a **proposed non-linear model**.

- partially replace non-social steps with **fully social counterparts**.
- better acknowledgement and coordination of **all social actors implicated in the innovation process**

Aims



Global experts in innovation from 4 continents convened in Lyon, France in **April 2010** to examine recent innovation research and practice.



Newfield, Christopher & Daryl Boudreaux, eds. *Can America Still Invent? Towards a New Model of International Innovation*. Manuscript in preparation.



Innovative Nanotechnology & Society Course Implemented at Community College

A new community college course, *Nanotechnology in Society*, was offered at Santa Barbara City College during Spring 2011. This innovative course was created through continued development of the 2008 INSCITES course, "*Green Works: Exploring Technology and the Search for Sustainability*". The INSCITES program, a partnership of the California Nanosystems Institute (CNSI) and CNS, is focused on blending historical context, basic scientific principles, societal implications, and technological understanding to develop truly interdisciplinary courses, open to all majors, with no prerequisites. To allow adoption of this curriculum at the community college level and to enhance the nanotechnology and sustainability foci, CNS faculty, Education Director, UCSB graduate students, and an SBCC instructor and administrator collaborated to revise and refine the course content. Seventeen students are currently enrolled in the first offering of this course.

Students in Professor Bullock's *Nanoscience in Society* course at Santa Barbara City College make solar cells using titanium dioxide and raspberry juice during one of the course's hands-on laboratory sessions.



Diverse enrollment

This collaboratively-developed curriculum has attracted a truly interdisciplinary audience.

Students enrolled in the SBCC *Nanotechnology in Society* course are pursuing a wide variety of degrees, including:

- Business economics
- Engineering (chemical, mechanical, electrical, and computer)
- Biology
- Political Science
- Manufacturing and welding
- Sports psychology
- Enology
- Media arts
- Emergency medicine
- Marine science
- Geology

STS grant PI: Julie Dillemoth, CNS-UCSB Education Director
Sub-Award PI: Eric Bullock, Santa Barbara City College
 CNS Graduate Student Researcher: Erin Calkins & Lily Welty

Co-PIs: Patrick McCray, CNS-UCSB co-PI and leader of IRG 1
 Peter Alagona, UCSB Professor of History
 Meredith Murr, UCSB Director of Research Development

curriculum dissemination



Undergraduates Research Societal Implications of Nanotechnology

For the 5th year running, in Summer 2010 CNS offered research opportunities for undergraduates from UCSB and community colleges. Interns, with majors ranging from mechanical engineering/math and chemistry to geography to business economics, spent 8 weeks engaging in graduate-level social science research under the guidance of CNS faculty, Postdoctoral Scholars, and Graduate Research Fellows. This internship program provides an entry point into technology in society research for students beginning their higher education, and seeks to foster their continuation along this research path.



2010 CNS Summer Research Internship Program group meeting

Internships are provided in partnership with the CNSI INSET program. In 2011, CNS will be offering additional internships through an added partnership with NNIN.

Recent research projects

The Geohistory of Nano Policy in the United States

Framing and How it Affects Public Perception of Nanotechnology

Nanotechnology in California

Assessing High-impact Contributions of Foreign-born Scientists to Nanotechnology Innovation

Spatial Analysis of the Early Nanotechnology Community (ongoing)



Interns presented and defended their results to an audience of science and social science academics. Venues included a research poster colloquium and oral presentations at UCSB, invitation to a national conference, and one poster was presented at an international conference in Germany.

For more info on the summer projects visit www.cns.ucsb.edu

Barbara Herr Harthorn, CNS PI and Director
Julie Dilleuth, CNS Education Director

8. STRATEGIC RESEARCH PLAN

The Center's research program is designed as a systematic analysis of historical and contemporary aspects of nanoscale science and engineering (NSE) policy and innovation systems for successful commercialization, globalization as a key factor in comparative economic development in East and South Asia, and emerging regulation and social perceptions of nanotechnologies as media and diverse publics become aware of them. Research in the renewal has been reorganized into three interdisciplinary research groups: **IRG 1 – *Origins, Innovations, and Institutions*** seeks to develop a rich understanding of the historical underpinnings of the current landscape of the nano-enterprise; **IRG 2 – *Globalization and Nanotechnology*** examines nanotechnology development under differing governmental approaches in China, Japan, and elsewhere in E. and S. Asia, to ask how different industrial policies, in combination with international cooperation and collaboration among researchers, shape distinctive nanoscience and industry outcomes; **IRG 3--*Risk Perception and Social Response***—focuses on understanding the dynamic nature of publics' and experts' perceptions and social intelligence about nanotechnologies, media framing of nanotech risks and benefits, social amplification and attenuation of risk, and methods for public engagement and deliberation. In addition, **X-IRG projects**—address strategic topics that span and integrate IRGs (e.g., nano solar energy, spatial analysis in the global value chain, nano lab ethnography). Together these provide a comprehensive understanding of current processes for successful development, commercialization, and global distribution of nanotechnologies. CNS-UCSB uses a strategic mixture of social, cultural, economic, political, and historical methods to address these issues at different scales, temporal frames, and resolutions. The composite picture of the emerging and growing nano-enterprise rendered by CNS-UCSB's research portfolio identifies and analyzes the critical issues for the safe, successful, *responsible development* of nanotechnologies in the global society. Important features of our collective approach are an integrated, participatory relationship with nanoscientists and engineers; a focus on specific nanotechnologies such as nanoelectronics, nanoparticles such as quantum dots, thin films, and nanoporous materials; comprehensive consideration of their applications in industries like electronics, energy, environmental, food, and health; and employment of advanced spatial analytic methods and a global framework for analysis.

CNS-UCSB views the linked set of foci of the CNS-UCSB on the scientific invention and economic development aspects of new nanotechnologies (IRGs 1 & 2), the meanings for risks and benefits that accrue on the societal side through media, expert & public processes (IRG 3), and the historical grounding of these in social, institutional, and policy contexts (IRG 1) as a highly productive, intersectional yet distinct mode of organizing a Center's collaborative interdisciplinary research and education. The 3 IRGs that form the core of CNS research are connected by numerous threads of common interests and some shared personnel, as well as the processes for integration that CNS-UCSB as a centralized, single campus center provides and continues to refine and develop. IRG 1 & 2 are combining expertise in examining industrial policies and their effects on nano development in East Asia; IRG 2 & 3 plan future work together on the nanotech workforce; and IRG 1 & 3 share interest in nano EH&S policy and NGO activities. IRG 1, for example, is looking at the policy history of both energy and EH&S issues with regard to nanotech. IRG 2 is engaged in a comparative study of national policies aimed at promoting nanotechnology research, development and commercialization in the U.S., China, Japan, Mexico, and – in coming years – other Latin American countries. It is also centrally concerned with workplace health and safety issues, an area it plans to pursue in connection with IRG 2 leader [Appelbaum](#)'s MacArthur Chair, which is focused on labor conditions in the Pacific Rim. IRG 3's research is moving further into experimental design modes to conduct multifactorial analysis of the drivers of emerging nanotech risk perceptions, looking specifically at the construction of (and reversals of) judgments of benefits *and* risks, counterintuitive findings and behavioral patterns that are of particular import to policy makers. New deliberative work funded by an NSF award 2008-2011 to PI [Harthorn](#) allows a closer focus on gender as a factor in risk perception and interactions in small group deliberative settings. The MacArthur Chair awarded in 2010 to IRG 2 leader [Appelbaum](#) will enhance CNS focus on jobs, job creation, and workplace

safety issues. IRG 1 leader McCray and collaborator Mody received a prestigious collaborative research fellowship from the American Council of Learned Societies for 2010-11. Funding to Harthorn, Satterfield & Kandlikar from the UC Center for Environmental Implications of Nanotechnology, 2008-2013, is producing new work on industry and public views of environmental risks of nano. Altogether, the CNS focuses on globalization, innovation, and risk, with central themes of inequality, vulnerability, product stigma, environment, and the production of policy-relevant results. CNS teams use a variety of comparative case analyses across specific nations (US, EU, E Asia), across applications for energy, environment, health, food, and water, and varying institutional practices (e.g., IP regimes) to highlight US nanotech R&D and public views and situate them in their comparative global context.



CNS' extensive collaborations with the UCSB CNSI, the UCSB Materials Research Laboratory (MRSEC), the College of Engineering and the Institute for Energy Efficiency, NSE participation on our National Advisory Board and Executive Committee, and the funded collaboration of the CNS-UCSB with the UC CEIN serve to provide a strong web of connections to the NSE, nanotoxicology and materials research communities. The years ahead will serve to further develop and strengthen these ties, for example through collaborative summer interns programs, joint events and programming, joint community college course development, and many other means. These connections and the highly interdisciplinary exchanges that are resulting from them are absolutely essential to the fulfillment of the CNS-UCSB research and education mission. Science and society work of the sort that is expected of the CNS requires the development of mutual regard and understanding across very great disciplinary divides, a process we as social scientists and humanists know needs to grow and develop organically to produce lasting institutional change. UCSB provides a possibly unique context for this experiment.

The integration, aggregation and synthesis of research results in the CNS take a number of forms. Years 1-5 have culminated with the production of numerous publications, reports, and other

materials that contribute to cutting edge theoretical and substantive issues in disciplinary research as well as the interdisciplinary space constructed by a highly multi-disciplinary national center such as CNS-UCSB. Center funding with its longer horizons and IRG collaborative enterprise enable a focused, summative evaluation of research that is not possible at the individual project level. At the IRG level, this includes state of the art analyses based on cumulative knowledge from the first 5 years of funding. For example, IRG 3 has produced a synthesis piece on nanotechnology upstream and midstream deliberation, based on what they have learned from conceptual work by Pidgeon and Rogers-Hayden in the UK, two sets of deliberative workshops in 2007 and 2009 by the full team (Harthorn, Pidgeon et al.), and meta-analysis of the published literatures (Satterfield et al.). IRG 3 is also developing a special journal issue based on its Jan 2010 specialist meeting that convened an international group of leading scholars to assess the state of knowledge about nanotech risk perception. Newfield's innovation X-IRG group hosted a workshop on global nano innovation in April 2010 in France that convened over a dozen leading innovation system analysts from North America, Europe, Asia and Africa, from which they are developing an edited volume synthesis publication. IRG 2 (Appelbaum et al.) took the lead on a large scale CNS-wide international conference in Nov 2009 in Washington DC on impediments to use of nanotechnologies for water, energy, health and food to help the world's poor. They have developed the results of that into an edited volume under contract to Routledge that aims to respond to the deep commitment in the CNS to ensure that issues of equitable development are addressed as a key aspect of responsible development of nanotechnologies.

In addition to the increasingly prolific production and dissemination of research results from individual IRGs via peer-reviewed journals, book chapters and pieces to many different kinds of audiences, CNS also culminated the first 5 years of Center support by producing an edited volume with the title *The Social Life of Nanotechnologies*, edited by CNS Director Harthorn and sociologist Mohr, under contract to Routledge. The volume brings together original work from all three research groups, probing the interactions and tensions between the modernist nanotechnology development enterprise with its focus on economic progress for the US and a postmodern social world concerned with issues of social progress and equitable development around the globe. CNS-UCSB Board Co-Chair John Seely Brown (author of *The Social Life of Information*, Harvard, 2000) is authoring a foreword to the book, which aims, like his earlier volume, to remind scientists, technologists, business and government that the social contexts of technologies demand close and careful attention and understanding.

As the CNS is actively developing a robust set of empirical data we have stepped up plans for interaction with and dissemination to diverse audiences from NSE researchers and students, to policy makers, to the nanotech industry, and to the diverse publics we study in our research. In the changing media environment, it is a challenge to create a thoughtful and effective approach to reaching key government, industry, labor, environmental, social group, and public audiences with the implications of our research. CNS research has much to offer such audiences. Currently, for example, IRG 2's comparative work suggests US investment in private sector early stage development may be necessary to effectively launch nanoenabled commercial developments in the current economy. IRG 3's survey research provides experimental evidence that it may be harmful to public acceptance to focus exclusively on the presentation of information about new nanotechnologies' benefits, something many in both science and industry assume as the preferred approach. Meanwhile IRG-1's work shows the trajectory of nanotechnology over a span of time which encompasses the Cold War, post-Cold War and immediate post-9/11 era. And the CNS NanoEquity work provides a strong basis for promotion of open source development strategies for humanitarian technological development. All CNS IRGs are using center resources to develop and consolidate policy relevant results that Center infrastructure in turn will enable us to disseminate effectively.

9. RESEARCH ACCOMPLISHMENTS, & PLANS

IRG 1: Origins, Institutions, and Communities

W. P. McCray , leader	History	UC Santa Barbara
C. Mody	History	Rice University
H. Choi	History	Chemical Heritage Foundation
D. Brock	History	Chemical Heritage Foundation
J. November	History	University of South Carolina

Affiliates

M. Mills	Media, Culture & Communication	New York University
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1 Postdoc, 3 Grads, 2 Undergrads

<i>Postdoctoral scholar</i>	Matthew Eisler, History of Science
<i>Graduate students:</i>	Summer Gray, Sociology (through Sept 2010)
	Roger Eardley-Pryor, History (from Sept. 2010)
	*Brittany Shields, History, Univ of Pennsylvania
<i>Undergraduate students:</i>	Samantha Rohman, Sabrina Wu, Nick Santos

IRG 1's goal 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. Since our last report, we have added a new research focus on nano-bio and refined our approach to carrying out our on-going oral history project. Our on-going work on nanoelectronics has expanded to include the Pacific Rim. Finally, research from our group was included in various ways in our classroom undergraduate teaching; [Mody](#), [McCray](#), and [Choi](#) all taught classes course on the history/sociology of technology which include some nano-themed topics.

IRG 1 was consistently productive during the first five years of the CNS. In Year Six, this pattern continued; our group has published or submitted for publication 38 articles, reports, essays, opinion pieces, book chapters, and reviews and written another 7. This includes 2 single-author monographs in press and another in progress. In addition, researchers from IRG 1 gave 16 talks at conferences and other forums in the United States and abroad. Details on the research performed by IRG 1 in the period between March 2010 and March 2011 follows.

IRG 1-1: Nanotechnology and the Pacific Rim

[Hyungsub Choi](#), [W. Patrick McCray](#), [Cyrus Mody](#)

This is a newest addition to IRG 1 and most of last year's efforts have been devoted to laying the groundwork for the project. In collaboration with Appelbaum (IRG-4), [Choi](#) has decided to focus on the rapid development of nanotechnology infrastructure of South Korea during the last decade. In the early part of last year, [Choi](#) conducted a comprehensive search on Korean periodicals on articles related to nanotechnology development, identifying major trends and constructing a timeline. In late 2010, [Choi](#) identified the National Nano Fabrication Center (NNFC), Daejeon, Korea, as an initial research site. The NNFC is the first and largest shared facility in Korea that provides silicon-based nano instrumentation and characterization services

to academia, industry, and government laboratories around the country. Established in 2004 with funds from the Ministry of Science and Technology (renamed the Ministry of Knowledge Economy), the city of Daejeon, and local industrial partners, the NNFC is now slated to become fully self-supportive by 2012. Examining the center's operation procedures will provide a useful window to observe the state of Korean nanoscale science and technology from a broad range of perspectives. Also, a case study of NNFC will provide opportunities for comparative analysis, especially with nanofabrication facilities in the United States, on which Mody has been working.

With CNS support (both from IRG 1 and 4), Choi is going on a research trip to Korea in March 15-30, 2011. He will be hosted by the Graduate School of Science and Technology Policy at the Korea Advanced Institute of Science and Technology, where NNFC is an affiliate. Choi has transmitted a short memo outlining his research plans to NNFC leadership, asking for interviews, observation session, and access to documents.

IRG 1-2: Pioneers of Nanotechnology (*Oral History Project*)

David Brock, Hyungsub Choi

In the period from March to September 2010, David C. Brock worked with IRG 1 team members to design a focused five-year effort to use oral history to document the historical development of nanotechnology. Through this design process, Brock and the IRG 1 team created a plan to develop two, in-depth oral histories with significant and diverse contributors to nanotechnology: pioneers of nanotechnology. These extensive interviews, analyzed in comparison to one another and to the documentary record, will provide an invaluable map of the actions of, motivations for, and interpretive understandings of important actors in the early development of nanotechnology. The Chemical Heritage Foundation's Oral History Program will transcribe and edit these pioneer oral histories. The completed oral histories will be available on the Web through the UCSB-CNS and the Chemical Heritage Foundation. Selection for prospective oral history interviewees will be guided by the intent to provide a broad coverage of the diverse contexts and types of activity involved in the development of nanotechnology, including scientific and technological contributions, policy development, and entrepreneurial pursuits.

From September 2010 to March 2011, Brock initiated efforts to create two in-depth oral histories per year with diverse, representative figures – pioneers – in the historical development of nanotechnology. Discussions with members of IRG 1 led to the selection of two individuals to pursue for the subjects of the first year's oral histories: James Von Ehr and Thomas Everhart. Von Ehr is a longstanding and prominent entrepreneur in nanotechnology, and Everhart is a leading academic figure both in the development of electron microscopy as a technique in nanotechnology and in the institutional development of nanotechnology in academe. Both Von Ehr and Everhart agreed to participate. The oral history interview with Von Ehr took place in January 2011, and has been transcribed. It is now in the editing process. An interview with Everhart is intended for March or May 2011.

Additional refinement of a set of prime candidates for oral histories is taking place on an ongoing basis. Currently, this set includes Mihail Roco, K. Eric Drexler, Donald Eigler, Sumio Iijima, Steve Jurvetson, Nadrian Seeman, Charles Lieber, Louis Brus, George Whitesides, Vicki Colvin, Wilson Ho, Lawrence Bock, Paul Alivisatos, Jane Frommer, Stuart Parkin, Horst Störmer, Steven Block, Harold Craighead, and Angela Belcher.

IRG 1-3: Institutions of Interdisciplinarity

Cyrus Mody, Hyungsub Choi

Area 3 members spent much of March 2010 to March 2011 conducting research and giving presentations, in preparation for more intensive collaboration with each other and other members of IRG 1 in the next reporting period. Mody and Gray completed research using the National Nanotechnology Infrastructure Network Societal and Ethical Implications travel grant by traveling to several NNIN facilities (esp. Stanford) and conducting interview and archival research. Choi, Gray, McCray, Mills, and Mody all presented findings at the annual 4S meeting in Tokyo, and Choi, McCray, Mills, and Mody were able to use that opportunity to plan for their American Council of Learned Societies Collaborative Research Fellowship tenure the following spring. In February, 2011, Mody and McCray presented papers (Mody's explicitly on interdisciplinarity) at a workshop at Princeton, and McCray, Mills, and Mody met at Rice University to plan collaborative activities and receive feedback from colleagues there. In the next reporting period, Choi, Mills, and Mody each expect to submit single and co-authored papers on interdisciplinarity to various journals.

IRG 1-3a – The Origins of Academic Interdisciplinarity Research: Emergence and Transformation of Materials Research Laboratories, 1960-1975

Hyungsub Choi

In the last year, the bulk of the research effort in this area has focused on the University of Pennsylvania. The collaboration with UPenn graduate student Brittany Shields has taken off, with the appointment of Shields as research fellow at the Chemical Heritage Foundation. Together, Choi and Shields have conducted a comprehensive search in the University of Pennsylvania Archives for materials related to the Laboratory for Research on the Structure of Matter. In addition, Shields has identified key documents at the Penn Facilities Resource Center, including early building layouts and plans for the new Penn nanotechnology research building that is currently under construction. Choi and Shields have also conducted one informal oral history interview with Elias Burstein, a retired faculty member from Penn physics. Based on this research, we plan to prepare a proposal for one of the fall conferences (2011 SHOT or 4S).

As a spinoff of the research supported by CNS during the last couple of years, Choi has prepared and submitted an NSF Scholars Award proposal, entitled “A Study of Interdisciplinary Materials Research and Training in the United States.” This project, comprised of detailed case studies of early Interdisciplinary Laboratories at Cornell University, University of Pennsylvania, and Northwestern University, will examine three themes: 1) Interdisciplinarity and the Built Environment; 2) Origin of the “Center Mode of Support”; and 3) “Training Interdisciplinary Researchers.”

IRG 1-3b – Building Interdisciplinary Institutions, 1975-2005

Cyrus Mody

Mody pursued two projects on interdisciplinary institutions during this reporting period. The first focuses on new interdisciplinary ventures in which Stanford electrical engineers participated between 1965 and 1995. This period spans from the turmoil of the Vietnam era to the emergence of the entrepreneurial, networked university of the post-Cold War period. All along, interdisciplinarity was seen as an important mode of research, though what interdisciplinarity meant and what problems it was seen as a solution to varied. The second project focuses on new forms of microelectronics promoted by a densely interconnected network of researchers at IBM, Bell Labs, MIT, and Cornell between 1970 and 1990. Building computer systems based on novel concepts such as the Josephson junction, and making the fabrication of microelectronics more “scientific” both required intensive forms of interdisciplinarity. In this reporting period, Mody conducted research at Stanford, IBM, Bell Labs, and elsewhere, and

presented papers on these topics at workshops at Oxford and Princeton and the annual meetings of SNET and 4S at Darmstadt and Tokyo.

IRG 1-3c – The Contested Nature of Interdisciplinarity in Nanoscience

Summer Gray, McCray and Mody

In the last few months of her CNS fellowship, Gray continued to conduct qualitative research measuring interdisciplinary activity as both ideology and practice, paying attention to U.S. federal policy discourse, important milestones in the institutional history of nanotechnology, and the internal dynamics of an NSF-funded nano center and its community of scientists. This work culminated with Gray presenting the results of her research at the Society for Social Studies of Science in Tokyo, Japan.

IRG 1-4: Innovation and Research at the Nanotechnology-Biology Interface

Joseph November

To elucidate the roots of federal agencies' recent efforts to foster innovation and research at the bio-nano interface, I intend to conduct a comparative analysis of early 1960s efforts to rationalize biomedicine via digital computer techniques and 21st century attempts to harness nanotechnology in life science research. Specifically, I will be investigating two attempts by the NIH to implement "bioengineering," one launched around 1960 and centered on the then-emerging technology of digital computing, the other launched around 2000 and grounded in today's emerging nanotechnology. Despite such different means, both varieties of bioengineering cast living systems as artifacts and cast those working with such systems as manageable engineers rather than scientists dependent on serendipitous breakthroughs. By historicizing the relations between technology development and the study of life, this case study aims to clarify the roles individuals and institutions in process that has made nanotechnology and biomedicine increasingly important to each other. This project will be grounded in extensive archival research at the NIH, the National Archives' collections, and historical materials available via the NSF and the NNI. It will also draw from data gathered in recorded interviews with personnel and grantees connected to agencies where nano-bio research is supported. To prepare for this work, I have been undertaking an review of the relevant literature and conducted travel planning.

IRG 1-5 (Nano)Technological Enthusiasm and the Public Imagination

Patrick McCray, Samantha Rohman

McCray continued work on the book manuscript for this research area. At this point, a first draft of the book is about 70% complete. In the past year, McCray also continued to collect and analyze primary source materials and conducted interviews (phone, email and in person) with a broadened set of informants and participants. The expected date for completion of this project is sometime in late 2011 or early 2012. In addition to book writing, McCray also gave several related talks at venues in the US and overseas.

IRG 1-6 Nanotechnology Narratives and U.S. Environmental, Health, & Safety (EHS) Policies

Roger Eardley-Pryor, Patrick McCray, Sabrina Wu

Eardley-Pryor joined IRG 1 in September 2010 with a goal to analyze and explain how popular utopian and dystopian narratives about nanotechnology have influenced the historical development of nanotechnology-related environmental, health, and safety (nanoEHS) policies in

the United States. Building upon prior and ongoing research conducted by IRG 1, this project seeks to integrate public and policy-maker imaginings of nanotechnology with the development of national and state nanoEHS policies.

Shortly after Eardley-Pryor affiliated with IRG 1, he attended the 2010 annual meeting of the Society for the History of Technology (SHOT), held in Tacoma, Washington, from September 30 to October 3, 2010. Eardley-Pryor accompanied IRG 1 leader, W. Patrick McCray, at SHOT, and he met other IRG 1 collaborators, including Cyrus Mody (Rice University) and David Brock (Chemical Heritage Foundation). At SHOT, Eardley-Pryor also met researchers with related interests, like Jody Roberts, who serves as the manager of the Environmental History and Policy program at the Chemical Heritage Foundation. Upon further discussion with both Roberts and McCray, Eardley-Pryor has planned a program of archival research to Philadelphia to explore two collections at the Chemical Heritage Foundation: the recently donated papers from the Environmental Protection Agency related to nanotechnology, and the papers of nanotechnology researcher and Nobel laureate, Richard E. Smalley. This work may inform subsequent human subject interviews. Eardley-Pryor's research trip is scheduled for late March and early April 2011.

Between September 2010 and March 2011, Eardley-Pryor also participated in various CNS activities. From September to December 2010, Eardley-Pryor collaborated with IRG-3 in the planning and execution of CNS's Graduate Workshop in Sociological Research, which explored various EHS concerns related to nanotechnology. Eardley-Pryor helped outline, introduce, and lead discussion of a seminar titled, "Developing EHS for ENMs: A Review of *Nano2: Nanotech Long-term Impacts and Research, 2000-2020*"; and in a seminar titled, "Popular Texts and Imaginary Visions of Nano-EHS Disasters," Eardley-Pryor presented on the use and misuse of nanotechnology in the recent remake of *The Day the Earth Stood Still* (2008). Through March 2011, Eardley-Pryor oversaw the work of undergraduate research intern, Sabrian Wu, while continuing his own collection and analysis of primary and secondary sources related to his CNS research interests.

Eardley-Pryor has since developed these interests into a project tentatively titled, "From Promise and Peril to Policy Formation: Toward an Environmental History of U.S. Nanotechnology Policy, 1992-2005." In it, he explores how early visions of manipulating matter at the nanoscale produced a wave of utopian expectations for exemplary environmental and health applications in such areas as energy, conservation, remediation, and medicine. Shortly after the establishment of the National Nanotechnology Initiative (NNI) and the escalation of American investment in nanotechnology, the once salubrious visions for nanotechnology's environmental impacts soon inspired tense skepticism. Leading voices, activists, and scientists produced new, dystopian visions of the death of nature, caused by out-of-control nanotechnology. These broad swings in public understanding of nanotechnology's environmental implications spurred new avenues of research, inspired debates on the definition and meaning of nanotechnology, and instigated the re-examination of policies for the safety of workers and consumers, as well as the health of the environment itself. This historical research project examines the fantasies and fears of policy-makers, scientists, civil society, and the American media as they all struggled to understand the impact nanotechnology would have on the future health of nature, the economy, and our bodies.

IRG 1-7 Nanoscale Science and Engineering, Federal R&D Policy, and Energy Conversion Technology

Matthew N. Eisler, McCray (supervisor)

In the period from March to September 2010, Eisler explored the historical antecedents of energy and power source-related nanoscale science, engineering, and technology (NSET). This work had two parts. The first analyzed the broad NSET activities of the Department of Energy from 1978 to 2000, focusing on the role of the Office of Basic Energy Sciences (OBES) in the creation of the National Nanotechnology Initiative. The second dealt with industry and DOE-backed NSET as it related to power sources such as fuel cells, batteries, and photovoltaic arrays from the late 1980s to the present.

Using the Smalley Papers at the Fondren Library of Rice University and the Chemical Heritage Foundation of Philadelphia as well as information gained in interviews conducted at conferences dealing in whole or in part with DOE energy and power source-related NSET in Santa Barbara (April), Albuquerque (August), and Maryland (December), Eisler completed a study of OBES's role in the NNI that is currently under referee review at *Social Studies of Science*. He also presented a draft study of the history of NSET in power source R&D at the Society for Nanoscale and Emerging Technologies Conference in Darmstadt, Germany, in October. Eisler plans to complete a formal paper on this topic by mid-2011.

From September 2010, Eisler has been exploring the NSET activities of the DOE in the post-NNI period. He is concentrating on the history and legacy of major DOE NSET user facilities built between 2000 and 2007, particularly the five Nanoscale Science Research Centers (NSRCs). Eisler will conduct a series of interviews with NSRC managers and users in the balance of 2011. The first will be with David A. Bunzow, the User Facilities Program Manager of the Molecular Foundry at Lawrence Berkeley National Laboratory on March 4, 2011.

IRG 1 Publications 2010-2011

1. Cyrus C.M. Mody. 2010. "Integrated Circuits: Material, Social, Spatial," *Volume* (24).
- 2-13. Cyrus C.M. Mody. 2010. Entries in *Encyclopedia of Nanoscience and Society*, ed. David H. Guston and J. Geoffrey Golson (London: Sage, 2010): "Chronology of Nanoscience": xxxiii-xliii; "Center for Biological and Environmental Nanotechnology": 76-78; "IBM": 325-328; "Interdisciplinary Research Centers": 348-350; "International Council on Nanotechnology": 351-353; "Microscopy, Atomic Force": 416-417; "Microscopy, Electron (Including TEM and SEM)": 417-419; "Microscopy, Exotic": 419-421; "Microscopy, Optical": 421-422; "Microscopy, Scanning Probe": 423-424; "Microscopy, Scanning Tunneling": 424-425; and "National Institute of Standards and Technology (U.S.)": 580-581.
14. Patrick McCray. 2010. "Re-Thinking Innovation: A New Agenda for Academic Investigation," *Science Progress*, (May), <http://www.scienceprogress.org/2010/05/re-thinking-innovation/>
15. Patrick McCray. 2010. "Unintended Consequences: What Ten Years of the National Nanotechnology Initiative Can Teach Us About Federal R&D," *Science Progress* (March) <http://www.scienceprogress.org/2010/03/unintended-consequences/>
16. Meredith Murr, Stacy Patterson, Evelyn Hu, Fiona Goodchild, and Patrick McCray. 2009. "From the Ground Up: Developing an Interdisciplinary Course Focusing on Materials Science and Society in Green Technologies," *Journal of Materials Education*, 31, 5/6: 251-264.(not previously reported)
- 17-22. Eisler, Matthew N. (2010). Entries. In David H. Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanoscience and Society* ("Nanotechnology in Manufacturing":548-551; "Department of Energy (DOE)": 153-154; "Occupational Safety and Health Enforcement": 610-612; "Science Policy": 702-704; "Self-Assembly": 709-710; "Spintronics": 735-736). London: Sage.

23. Cyrus C.M. Mody. "Conferences and the Emergence of Nanoscience." In *Social Life of Nanotechnologies*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (forthcoming, expected 2011/2012).
24. Cyrus C.M. Mody. *Instrumental Community: Probe Microscopy and the Path to Nanotechnology*. MIT Press (forthcoming).
25. Matthew Eisler. "Where Nano Came From." In *Nanotechnology and the Public Sphere: Risk Perception, in Risk Communication, and Public Engagement*, Ed. Susanna Priest. (forthcoming)
26. Matthew Eisler and Yasuyuki Motoyama. "Bibliometry and Nanotechnology: A Meta Analysis," *Technological Forecasting and Social Change* (forthcoming).
27. Matthew Eisler. 2011. "Discourses of Revolutionary Applied Science and the Department of Energy," *Science and Public Policy* (forthcoming, December).
28. Matthew Eisler. "Shifting Molecules, Mixing Metaphors: A Short History of Science, Technology, and Energy," *Science Progress* (forthcoming).
29. Matthew Eisler. "'You Say You Want a Revolution:' Nanotechnology and Continuity and Change in U.S. R&D Policy," *The Social Life of Nanotechnologies*, Eds. Barbara Harthorn and John Mohr. Routledge (forthcoming, expected 2011/2012).
30. Matthew Eisler. *Overpotential: Fuel Cells, Futurism, and the Making of a Power Panacea*. \ Rutgers University Press (forthcoming, 2011)
31. Patrick McCray. "From L-5 to X-Prize." In *Blue Sky Metropolis: Aerospace and Southern California*, Eds. Peter J. Westwick and William Deverell. University of California Press (forthcoming).
32. Patrick McCray. "California Dreamin': Visioneering the Technological Future." In *Minds and Matters: Technology in California and the West*, Ed. Volker Janssen. University of California Press (forthcoming).
33. Patrick McCray. "When Space Travel and Nanotechnology Met at the Fountains of Paradise." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge Press (expected 2011).
34. Christophe Lécuyer and Hyungsub Choi. "How Did Semiconductor Firms Manage Technological Uncertainty," *La Revue d'Histoire Moderne et Contemporaine* (forthcoming).
35. Cyrus C.M. Mody. "Climbing the Hill: Seeing (and Not Seeing) Epochal Breaks from Multiple Vantage Points." In *Science and Its Recent History: Epochal Break or Business as Usual?*, Eds. Alfred Nordmann, Hans Radder, and Gregor Schiemann. University of Pittsburgh Press (forthcoming).
36. Matthew Eisler. "Saving the Phenomenon: Basic Energy Science and the Redemptive Power of Nanotechnology," *Social Studies of Science* (under review).
37. Cyrus C.M. Mody, "Essential Tensions and Representational Strategies." In *Representation in Scientific Practice II*, Eds. Michael Lynch, Steve Woolgar, Janet Vertesi, and Catelijne Coopmans. MIT Press (under review by volume editors).
38. Sonali K. Shah and Cyrus C.M. Mody. "Innovation, Social Structure, and the Creation of New Industries," *Academy of Management Journal* (under review).

In preparation

1. Patrick McCray. *Histories of Our Technological Future: How Space Colonies, Nanotechnology, and Transhumanism Challenged the Idea of Limits*. Book project in progress; under contract with Princeton University Press, target submission date of early 2012.
2. Patrick McCray. "Timothy Leary's Transhumanist SMI²LE," book chapter in progress for *Groovy Science: The Counter-Cultures and Scientific Life, 1955-1975*, Ed. David Kaiser.

3. Cyrus C.M. Mody and Andrew J. Nelson. "Soothing the Savage Student: Music Meets Engineering at Vietnam-Era Stanford," *Osiris* (invited to contribute to volume 28, *Music in the Laboratory*).
4. Cyrus C.M. Mody and Hyungsub Choi. "From Materials Science to Nanotechnology: Institutions, Communities, and Disciplines at Cornell University, 1960-2000," to be submitted to *Historical Studies in the Natural Sciences*.
5. David C. Brock and Hyungsub Choi. "Semiconductor Technology Roadmapping: Origins, Functions, and Exemplary Status," manuscript in progress.
6. Hyungsub Choi and Takushi Otani. "The Japanese Integrated Circuit and the Limits of Technology Followership," manuscript in progress for *IEEE Annals of the History of Computing* (special issue on the history of integrated circuits).
7. Cyrus C.M. Mody. "An Electro-Historical Focus with Real Interdisciplinary Appeal: Interdisciplinarity at Vietnam-Era Stanford," for *Groovy Science: The Counter-Cultures and Scientific Life, 1955-1975*, Ed. David Kaiser (possible edited volume contribution).

IRG 1 Presentations 2010-2011

1. Choi. "Semiconductor Technology Licensing in the 1950s," Forum on Innovation Studies, Hitotsubashi University, Tokyo, Japan, March 9, 2010.
2. McCray. "Spinning Innovation," States of Innovation, international workshop at University of Lyon, France, April, 2010.
3. McCray. "Visioneering: Histories of Radical Technological Optimism," invited talk at Northwestern University - Qatar campus, Doha, May, 2010.
4. Choi. "The Spatiality of Materials Science," Society for Social Studies of Science, Tokyo, Japan, August 26, 2010 (presenter, chair, and organizer of the session "Micro-Histories and Nano-Futures").
5. Mody. "From Microscience to Nanotechnology, 1970-2000," Society for Social Studies of Science annual meeting, Tokyo, Japan, August 26, 2010.
6. McCray. "Two-Part Harmony: Nanotechnology's Early Communities of Support," presented at annual meeting of Society for Social Studies of Science, Tokyo, August, 2010.
7. Gray. "From Substance to Appearance: The Question of Interdisciplinarity and Nanotechnology in the US," Society for the Social Studies of Science, Tokyo, Japan, August, 2010.
8. Mody. "The Political Economy of the Knowledge Economy: Interdisciplinarity at Vietnam-Era Stanford," Interdisciplinary Pedagogies and the "Knowledge Economy" invited workshop, Oxford, UK: Scientific Collaboration, September 9, 2010.
9. Mody. "The Feynman Legacy," Society for the Study of Nanoscience and Emerging Technologies, Darmstadt, Germany, September 30, 2010.
10. Eisler. "Making Nanomaterials Work in Energy Conversion," SNET 2010 conference, Darmstadt, Germany, 10-1-2010
11. Gray. "The Geohistory of Nano-Policy in the US," Society for the Study of Nanoscience and Emerging Technologies, Darmstadt, Germany, Sept 30, 2010.
12. Eardley-Pryor. "Review of Nano2: Nanotech Long-term Impacts and Research, 2000-2020," presentation and discussion at CNS-UCSB Seminar, October 20, 2010.
13. Mody. "Interdisciplinarity and Vietnam-Era Protest at Stanford," Rice Center for Biological and Environmental Nanotechnology-Student Leadership Council semimonthly lunch talk series, Houston, Texas, October 28, 2010.
14. Choi, "Transistor States: Semiconductor Industry and the Government in the United States and Japan," Hagley Research Seminar, Hagley Museum and Library, Wilmington, Delaware, December 16, 2010.

15. McCray. "Timothy Leary's Transhumanist SMI²LE," Groovy Science workshop, Princeton University, February 5, 2011.
16. Santos. "The Geohistory of Nano Policy in the United States," poster session at Association of American Geographers, Seattle, WA, April 12, 2011.

IRG 2: Globalization and Nanotechnology

R. Appelbaum , Leader	Sociology, Glob. & Int'l Stud.	UC Santa Barbara
G. Gereffi	Sociology	Duke University
T. Lenoir	History	Duke University
A. Mehta	Global & International Studies	UC Santa Barbara
F. Block	Sociology	UC Davis
C. Cao	Contemp. Chinese Studies	Univ. of Nottingham
H. Choi	History	Chemical Heritage Foundation

Affiliates

R. Parker	Research Staff Member	Science & Tech. Policy Inst.
P. Herron	Computer Science	Duke University
G. Folodari	Sociology	Univ. Autónoma de Zacatecas
E. Zavago Lau	Researcher	Latin Amer. Nanotech & Society Network (ReLans)

2 postdocs, 5 grads, 2 undergrads

<i>Postdoctoral scholar</i>	Yasuyuki Motoyama, Regional Planning
	Stacey Frederick, GIS Postdoc
<i>Graduate students:</i>	Social Science: Rachel Parker, Sociology (through Jun 2010), James Walsh, Sociology: Sarah Hartigan, Global & International Studies
	Science and Engineering: Claron Ridge, Chemistry/Biochemistry; Peter Burks, Chemistry/Biochemistry
<i>Undergraduate Students:</i>	Andi Doktor, Joy Yang, Srijay Rajan

IRG 2-1: China's Developmental State: Becoming a 21st Century Nanotech Leader

[Appelbaum](#), [Parker](#), [Cao](#), Burks

This research stream aims at understanding where China stands in terms of innovation, R&D, and commercialization of nanotechnology, examining the degree to which China has a more centralized approach to funding for nanotechnology along the value chain, particularly towards the commercialization end. China is convinced that manufacturing prowess alone is insufficient to becoming a leading economic power in the 21st century. China's overarching goal is to become an "innovation-oriented" society by the year 2020. Since the Third National Conference on Science and Technology in 1995 when "The Decision on Accelerating Scientific and Technological Progress" was announced, "indigenous innovation" (or *zizhu chuangxin*) has been heralded as the source of China's future development, and science, technology and education were identified as the tools that will create national prosperity and reduce the inequality that currently threatens China's rapid development. Our research examines the ways in which the debate over innovation is shaping national development in China, with nanotechnology providing a case study. We seek to better understand whether China's relatively government-centered approach toward science and technology policy can succeed in creating the bases for genuine innovation, in light of its distinctive approach to technological leapfrogging, the institutional features of its innovation system, and nanotechnology's status as an early stage emerging technology.

Previously this research stream focused on the research end of the research-development-commercialization process. In a May 2010 trip to China, Appelbaum, Cao, and Parker visited firms and policy-makers to get a better sense of how effectively China is commercializing its advances in nanotechnology. Interviews were conducted at the Chemical Engineering College, Beijing University of Chemical Technology; Key Lab for Thin Film and Microfabrication, Ministry of Education; Shanghai Nanotechnology Promotion Center; Research Center of Nano Science & Technology, Shanghai University; Wison, Genor BioPharma Co., Ltd., Pudong Shanghai; Suzhou Industrial Park Administrative Committee; BioBay Science/Innovation Park, Suzhou; Sirnaomics, Suzhou; Dow Chemical China Company Ltd., Shanghai; OptoTrace, Suzhou; NanoMed, Suzhou; Hiwyteck, Suzhou; Suntech, Wuxi; and Jiansu Hehai Nanometer Science & Technology Co., Ltd., Taixing City. In January-February, 2011, Burks did a 6-week internship at Sinano in Suzhou Industrial Park; his interviews included Sinano and Suzhou Industrial Park. Cao is preparing an initial draft of a paper on Chinese nanotech commercialization based on this research (expected completion mid-March 2011).

IRG 2-2: Comparative Study of State Nanotechnology Policy: U.S., China, Japan

Appelbaum, Parker, Ridge, Motoyama

One central theme of our research is the role of public investment as a driver for nanotechnology. To what extent do government-funded national nanotechnology initiatives constitute industrial policy? What are the results of different governmental approaches, in terms of publications, patents, and commercialization? Much of our research to date has focused on China, where government efforts appear to reach further into the commercial end of the value chain than in the U.S. Our China research concludes that China's substantial investment in nanotechnology – one of four “science megaprojects” under the Medium and Long-Term Plan (for high technology) – has paid large dividends at the research stage, but has yet to result in significant commercial payoff. While this is true in other countries as well, China faces the additional challenges of having a risk-averse state sector, an SME sector that is growing but undeveloped, and a university and science academy-based research sector that lacks entrepreneurial experience.

This research stream builds on the previous research done in China, and seeks to better understand the role of state policy as a driver of nanotechnology R&D and commercialization. We have developed a comparative methodology that uses similar kinds of data (for example, public documents, published reports and studies, differences in IP protection law, analysis of patent and publication data). The first step has been to focus on the U.S. NNI in an effort to better understand funding allocations across agencies, especially programs such as SBIR and STTR that are more directly focused on commercialization. This study of the US NNI concludes that while the NNI can be seen as an example of industrial policy (it was initiated within NSF and OSTP, rather than resulting from “grassroots” pressure from scientists or business people), most of the funding has been at the research end (to universities and government labs), with only a small portion directed to support businesses.

The project post-doc, Yasuyuki Motoyama, is using this framework for one of his projects, a comparative study of nanotechnology policy in the U.S. and Japan (his hypothesis is that, contrary to conventional thinking, the U.S. has a more aggressive industrial policy in this area than Japan). Appelbaum, Parker, and Cao will provide a comparative analysis of the U.S. and China. A draft of this paper has been written, and will be updated and completing for Harthorn and Mohr, *The Social Life of Nanotechnology*.

IRG 2-3: The Implications of China's Move to High-Tech Innovation for U.S. Policy Appelbaum, Parker

The economies of the U.S. and China are currently deeply intertwined: innovation, product design, and marketing originate with U.S. (and other foreign) firms; contract manufacturing occurs in China; and final products are sold to U.S. (and other advanced economy) consumers. On the U.S. side, firms benefit from low-cost labor; U.S. consumers benefit from low-cost products (contributing to historically low rates of inflation that partly mitigate sluggish middle class income growth); and U.S. government debt is financed by Chinese purchase of government securities. On the Chinese side, tens of thousands of factories benefit from contract work for U.S. (and other foreign) firms; hundreds of millions of workers benefit from waged salary, if often under harsh conditions in violation of ILO minimal standards; the Chinese government has accumulated significant foreign reserves (now approaching \$1.9 trillion from all sources), which in turn help to finance significant investments in infrastructure; and the Chinese economy continues to grow at 10% annually as a result.

China's turn to indigenous innovation heralds a major shift in economic strategy, one that will lead to a partial uncoupling from what has thus far been a mutually advantageous relationship with the U.S. and other foreign economies. If China is successful in its efforts, it will in 10-15 years be competing head-on with foreign firms – designing, branding, and marketing its own innovative products to hundreds of millions of Chinese consumers. In other words, one possible future for China will be to become more economically autonomous than it has been thus far. In a paper (and a series of February 2011 presentations in Delhi and Hyderabad, India), we are exploring possible ramifications of these trends, in particular the opportunities for increased scientific collaboration between China and the U.S.

IRG 2-4: Drivers of Nanotechnology Commercialization in China: Patent Analysis Parker, Appelbaum, Motoyama, Lenoir, Herron, Ridge

We have acquired a dataset of Chinese nanotech patent data from Donghua ZHU, Vice Dean, School of Management and Economics, and Director, Laboratory of Knowledge Discovery and Data Analysis at Beijing Institute of Technology (his lab is the lead agency in China analyzing such data). Our purpose is to better understand the prospects for commercialization in China, and possibly to identify particular firms or researchers for follow-up interviews. The data-set of Chinese nanotechnology patents based on a random sample, and would additionally includes the abstracts of all nanotech patents issued in China for the period 1985-2008. In addition to the raw data, we were provided with a 74 page "Analysis Report of Nanotechnology Chinese Patents," as well as the complete patents (in Chinese) in four areas: thin films, quantum dots, carbon nanotubes, and nanoporous filtration.

The team has subsequently conducted its own analysis of this data. One key finding is that while the number of nanotechnology patent applications in China has grown markedly in recent years, most patents come from the country's research institutions such as major universities and the Chinese Academy of Science, and not the private sector. Many patents also "sleep in the safe," most likely taken out primarily to justify funding or discourage foreign patenting. Furthermore, as many as two-thirds of all Chinese patents are design model or utility model patents, which are far more readily conferred by SIPO than invention patents, further discouraging foreign competitive patenting.

We are continuing to analyze Chinese patent data, now in cooperation with the larger patent and publication database analysis under development with our partners at Duke University (see next section).

IRG 2-5: Comparative Statistical Analysis of Nano throughout the world

Lenoir, Herron

Our Duke team has made considerable advances in their development of a large scale *globonano database* to support quantitative research on the development of scientific literature, patents, and products in all fields of nanotechnology for several countries, including the US, China, South Korea, Japan, India, and Singapore, but also every country for which data is available. (A student database programmer, hired with a supplemental \$10,000 grant from our working group, has assisted Lenoir and Herron.) The goal of this project is to measure nanotech output and changes on terms of intellectual property, publications, actors, firms, states, policies, manufacturing, and trade.

Thus far, a scientific literature database consisting of metadata records for 420,000 nanotechnology publications completed. A major accomplishment has been to collect, upload, and automate the assignment of geocodes for the globonano database. The creation of this globonano database is now virtually complete, with more than 516,000 unique addresses identifying, requiring approximately 3,000 lines of code written in bash, sed, awk, java, SQL, and Python. We have also collected European Patent Office (EPO) data for 80 countries, involving some 70 million records; uploading the patent data to the globonano database is expected to be completed by mid-March. Finally, we are supplementing the globonano database with an inventory of nano-related products; thus far, 5,141 products from 189 companies have been identified. We are working with Stacey Frederick (see below), who is also compiling an inventory of nano-related products.

We are now beginning to develop analytics software that will enable us to analyze the globonano database, including the visualization of results. This stage will continue for the remainder of the calendar year.

IRG 2-6: Global Value Chain Analysis

Frederick, Gereffi, Appelbaum, Harthorn, Goodchild

This project entails value chain mapping of California and the United States in the global nanotechnology economy. Objectives include (1) identifying firms working in each stage of the supply chain from nanomaterials through end-markets, (2) analyzing the impact of value chain dynamics in each stage such as policies, risk, perception, and competitiveness factors, and (3) evaluating how these are linked together in California and how California compares to competing geographies. Outcomes will include a California in the Nanotechnology Global Economy website.

Two preliminary website templates have thus far been created: one for the value chain research framework, and the other designed to provide a framework for carrying out the California in the Nano Global Economy project. To accomplish these goals, Frederick has been reviewing existing data mining and mapping methodologies to determine their applicability to nanotechnology publications, patents, funding sources, and firms. The ultimate goal is to identify ways to link this information to the value chain framework, enabling users to visualize the results. Existing visual mapping programs, and their associated costs, are being examined. (For an example of what we are striving for, see the North Carolina in the Global Economy

website, which Frederick developed.) Frederick has also met with organizations involved in the North Carolina nanotechnology industry, to discuss possible synergies between efforts in NC and the California project. Finally, she is also developing an inventory of nanoproducts, and will coordinate this effort in the future with Lenoir and Herron.

This project is should be completed by the end of the calendar year, and then maintained throughout the life of CNS. We are considering expanding it to all nano products (not just those associated with California).

IRG 2-7: International Collaboration in Nanotech Research and Publication Quality

Mehta, Lenoir, Herron, Motoyama

Most countries engaged in nanotech research encourage international research collaborations. This work in progress analyzes a bibliometric dataset covering half a million nanotechnology publications from 40 countries over the past 30 years, taken from ISI using the Kostoff search query, to assess: (1) which countries are most heavily involved in these collaborations, who they partner with, and how this has changed over time; and (2) the statistical relationship between collaboration and study impact (proxied for by citation counts), and how this has varied across time and over countries. Previous studies find that China has made greater gains in publication frequency than in impact. A central question is whether international collaboration has helped China to close this gap. This project is in its initial stages (a Santa Barbara meeting between Mehta and Herron was held during the second week of March).

IRG 2-8: Contributions of Foreign-Born Scientists to Nanotechnology Innovation

Walsh, Ridge

This research employs an original data-set to examine the nativity of scientists making significant contributions to nanotechnology research and innovation. In addition to identifying individuals central in nano-innovation, the research highlights the internal globalization of the American scientific community and informs intellectual and policy debates on immigration and its impacts on the American knowledge economy. Kotoff's bibliometric methods were used to collect all journal articles on nanotechnology between 1999-2009. These were ranked by number of citations; the top 1%- or high-impact- articles were included in the study, which recorded the names of both corresponding and non-corresponding authors. Sources such as the biographical reference work *American Men and Women of Science*, department and faculty web pages, and Linked-In were used to determine the nativity of the population. Aggregate and yearly figures were benchmarked against the prevalence of the foreign-born in both the American scientific labor force and general population.

Preliminary analysis shows that the prevalence of the foreign-born significantly exceeds that of the general population and American Scientific community. Several trends are also apparent. First, both the number of nanotechnology related articles and the number of foreign-born contributions increased each year. While the United States contributed the largest share of corresponding authors China, India and Germany also made significant contributions. This analysis will be completed by the end of the calendar year.

A related study examines all nanotechnology-related dissertations, which are suggestive of emerging areas of specialization. Using the UMI electronic dissertation database through Proquest, Walsh and Ridge have identified the authors of all dissertations related to nanotechnology granted at US institutions between 1999-2009 (a total of 4,616 individuals). To

date they have identified the population of relevant participants. The next step is to derive a random sample of all Ph.D.'s, and then conduct a survey that will provide basic demographic information, as well as information concerning place of birth, citizenship and migration history. This will permit some insights into the career trajectories of foreign-born recipients of U.S. Ph.D.'s in nanotechnology.

IRG 2-9: UCMEXUS/CONACYT award (\$25,000): Binational Collaboration (USA-Mexico) in the Development of Nanotechnology

Foladori, Zayago Lau, Appelbaum, Parker

This joint project, with the Doctoral Program on Development Studies at the University of Zacatecas (Mexico), analyzes the development trajectory of nanotechnology in Mexico, with special attention to scientific collaboration and productive agreements between U.S. and Mexican institutions. This is seed funding to determine key topics capable of being researched in future joint activities between the two research teams. Because the Mexican principals are associated with ReLANS (the Latin American Nanotechnology and Society Network), it will also give us the ability to expand our comparative studies to Latin America beyond Mexico. Thus far we have had one meeting in Santa Barbara; a second will occur in conjunction with the research summit in March, and a third at the SASE meetings in Madrid in June, where we are hosting a panel.

IRG 2-10: Emerging Technologies/Emerging Economies: [Nano]Technology for Equitable Development, conference held in Washington, D.C. November 4-6, 2009

Parker, Appelbaum

IRG 2 researchers believe that nanotechnology (and other emerging technologies) hold the promise of solving some of the world's most critical problems related to energy scarcity, finite clean water sources, diminished availability of sustainable food resources, and pandemic diseases. Increased international collaboration on technological innovation can help advance progress in these four areas, while also reducing inequality between the global North and South. In a 1st step toward such collaborative innovation, IRG-4 (and CNS) hosted an international conference in Washington, D.C. November 4-6, 2009 to explore these possibilities. The conference was a collaborative effort of CNS-UCSB which organized the conference with the Woodrow Wilson International Center for Scholars (the host organization), and Rice University's Center for Biological and Environmental Nanotechnology. The roughly 85 participants came from the US and Europe; China, India, and Brazil, the world's three largest emerging economies; and Mexico, South Africa, Uganda, and Zimbabwe, and included leading scientists and engineers, government employees and NGO activists, social scientists and new technology business entrepreneurs. Discussion and dialogue were facilitated by the Meridian Institute, an organization committed to increasing more equitable North/South dialogue. A central concern of the conference was how to best manage global science and technology development to ensure that the benefits of technological advancement contribute to equitable development.

We have completed the book manuscript resulting from the conference, consisting of 18 chapters, which are now undergoing final review by Routledge, which hopes to publish later this year.

IRG 2 Publications 2010-2011

- 1) Parker, Rachel. 2010. "Science, Technology, and Innovation Policy: High-tech Industry Growth in China," Doctoral dissertation, Department of Sociology, University of California, Santa Barbara, July 2010.
- 2) Richard Appelbaum. 2011. "Will China Eat Our Lunch? Review of Denis Fred Simon and Cong Cao, *China's Emerging Technological Edge*." *Asia Policy* (January): 160-164
- 3) Richard Appelbaum, Rachel Parker, Cong Cao, and Gary Gereffi. 2011. "China's (Not So Hidden) Developmental State: Becoming a Leading Nanotechnology Innovator in the Twenty-first Century." In *State of Innovation: The U.S. Government's Role in Technology Development*, Eds. Fred Block and Matthew R. Keller. Boulder, CO: Paradigm Publishers.
- 4) Richard Appelbaum, Rachel Parker, and Cong Cao. 2011. "Developmental State and Innovation: Nanotechnology in China." *Global Networks* 11:3 (July).
- 5) Yasuyuki Motoyama, Richard Appelbaum, and Rachel Parker. 2011. "The National Nanotechnology Initiative: Federal Support for Science and Technology, or Hidden Industrial Policy?" *Technology in Society*.
- 6) Yasuyuki Motoyama and Matthew Eisler. 2011. "Bibliometry and Nanotechnology: A Meta-Analysis." In *Technological Forecasting and Social Change*.
- 7) Richard Appelbaum and Rachel Parker. "The Promise and Perils of High-Tech Approaches to Development." In *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?*, Eds. Rachel Parker and Richard Appelbaum. Routledge (forthcoming 2012).
- 8) Rachel Parker and Richard Appelbaum. "Emerging Technologies/Emerging Economies: Nanotechnology for Equitable Development." In *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?*, Eds. Rachel Parker and Richard Appelbaum. Routledge (forthcoming 2012).
- 9) Rachel Parker and Richard Appelbaum (eds.), *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Routledge (forthcoming 2012).
- 10) Richard Appelbaum and Cong Cao. "The Chinese Century? Some Implications of China's Move to High-Tech Innovation for U.S. Policy." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge (expected 2011/2012).
- 11) Rachel Parker, Richard Appelbaum, and Yasuyuki Motoyama. "Industrial Policy and Nanotechnology Development: Does Public Investment Pay off?" In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge (expected 2011/2012).

In Preparation

- 1) Richard Appelbaum and Rachel Parker. "The Chinese Century? Some Policy Implications of China's Move to High-Tech Innovation."
- 2) Yasuyuki Motoyama and Richard Appelbaum. "Observing regional divergence in Chinese nanotechnology centers" (in preparation and invited to *Regional Science Policy and Practice*).
- 3) Julie Dilleuth, Stacey Frederick, Rachel Parker, Rich Appelbaum, and Gary Gereffi. "Traveling Technologies: Societal Implications of Nanotechnology through the Global Value Chain." Forthcoming in *Journal of Nano Education*.
- 4) Cong Cao, Richard Appelbaum, and Rachel Parker. "Commercialization of Nanotechnology in China"

IRG 2 Presentations 2010-2011

- 1) Appelbaum and Chmelka. "New Nanoscale Materials for the Future of Energy: a community discussion," Nanometer, University Club, Santa Barbara, CA, March 11, 2010.
- 2) Appelbaum and Parker. "Emerging Economies/Emerging Technologies: Prospects for Equitable Development," International Sociological Association quadrennial meetings, Göteborg, Sweden, July 16, 2010.
- 3) Motoyama. "Bridging Science and Innovation? A case study of U.S. National Nanotechnology Initiative," Society for Social Studies of Science, Tokyo, Japan, August 27, 2010.
- 4) Parker. "Multi-Walled Carbon Nanotubes in Water Filtration Systems: From New Material Innovation to New Product Innovation," Chemical Heritage Foundation Innovation Day, Philadelphia, PA September 22, 2010.
- 5) Herron and Lenoir. Presented their CNS work at the Data and Cognition Panel of the Society for Literature, Science, and the Arts (SLSA) Annual Meeting, Indianapolis, IN, October 28, 2010.
- 6) Motoyama. "Reflections on Competitiveness and Collaboration" CNS Seminar, Santa Barbara, CA, January 12, 2011.
- 7) Appelbaum. "China's Rise as a High-Tech Power: Challenges and Opportunities," Giri Deshingkar Memorial Lecture, India International Centre, University of Delhi, February 16, 2011.
- 8) Appelbaum. "China's Rise as a High-Tech Power: Some Implications for U.S. Foreign Policy," School of International Studies, Jawaharlal Nehru University, Delhi, February 18, 2011.
- 9) Appelbaum. "China's Rise as a High-Tech Power: Challenges and Opportunities," Centre for Human Rights, University of Hyderabad, February 21, 2011.
- 10) Appelbaum. "China's Rise as a High-Tech Power: Challenges and Opportunities," National Academy of Agricultural Resource Management, Hyderabad, all-day conference on "Brainstorming Workshop on Prospects of Nanotechnology in Agri-value Chain," February 22, 2011.
- 11) Appelbaum. "China's Rise as a High-Tech Power: Some Implications for U.S. Foreign Policy," Santa Barbara Institute on World Affairs, inaugural event, Lobero Theater, February 26, 2011.
- 12) Mehta. "International Collaboration and Paper Impact in Nanotechnology," CNS Seminar, Santa Barbara, CA, March 9, 2011.

Meetings attended:

Walsh: NSTI, AAAS

IRG 3: Nanotech Risk Perception and Social Response

B. Herr Harthorn , Leader	Anthropology	UC Santa Barbara
N. Pidgeon , Co-leader	Social Psychology	Cardiff University, UK
T. Satterfield , Co-Leader	Environmental Risk	University of British Columbia, CA
B. Bimber	Political Science	UC Santa Barbara
J. Conti	Sociology, Law	University of Wisconsin, Madison
S. Friedman	Science Journalism	Lehigh Univ, Bethlehem, PA
R. Gregory	Env Risk	Decision Research, OR
M. Kandlikar	Science policy	University of British Columbia, CA
P. Slovic	Psychology	Decision Research, OR

Affiliates

E. Barvosa	Chicana/o Studies	UC Santa Barbara
F. Bray	Anthropology	Edinburgh University, UK
K. Bryant	Sociology	SUNY New Paltz
J. Earl	Sociology	UC Santa Barbara
B. Egolf	Sci Journalism	Lehigh Univ
W. Freudenburg*	Env Sociology	UC Santa Barbara
H. Haldane	Anthropology	Quinnipiac University, CT
P. Holden	Microbiology	UC Santa Barbara
M. Metzger	Communication	UC Santa Barbara
J. Rogers	Sociology	Long Island University, NY
T. Rogers-Hayden	Environmental risk	University of East Anglia, UK

* deceased Dec 2010

3 [+3] Postdocs, 12 [+6] Grads, and 3 Undergrads*Postdoctoral researchers:*

*Christine Shearer, Sociology
 *Gwen D'Arcangelis, Women's Studies
 *Jennifer Rogers, Sociology
 Meredith Conroy, Political Science
International: *Adam Corner, Social Psych (Cardiff UK)
 *Anton Pitts, Environmental Risk (UBC)

*Graduate students:****Social science/humanities:***

Meredith Conroy, Poli Sci
 Lauren Copeland, Poli Sci
 Rachel Cranfill, Linguistics
 Amanda Denes, Communication
 *Cassandra Engeman, Sociology
 Christine Shearer, Sociology
 Silke Werth, E.Asian Lang & Cultural Studies
 Qian Yang, E.Asian Lang & Cultural Studies

Nanoscience/Ecotox/EnvSci:

*Lynn Baumgartner, Env Sci & Mgt
 *Ben Carr, Env Sci & Mgt
 *Allison Fish Env Sci & Mgt
 *John Meyerhofer, Env Sci & Mgt
 Shannon Hanna, Environmental Science
 Erica Lively, Electrical Engineering
 Tyronne Martin, Chemistry

International: Christian Beaudrie, Environmental Risk (UBC)

Undergraduate students: *Laura Devries, Environmental Risk (UCB)
 UCSB: Julie Whirlow, Psychology
 UCSB: Brent Boone, Business Economics
 *Univ of Wisc: Sean Becker, Sociology
 Community college: Simone Jackson
**partially or fully co-funded from another source*

Will nanotechnologies experience public backlash and stigma when they are developed and disseminated that could limit the realization of their potential economic and/or social benefits? The answer to this deceptively simple question hinges on a complex set of social, political, economic, and cultural factors that are likely to drive sustainability and acceptance or controversy and failure. In addition to economic issues such as job creation or loss, primary focal points of public concern are likely to be risk, regulation, trust, responsibility, and justice, and the degree to which experts share, anticipate, and address these concerns is a powerful predictor of the likelihood of ensuing controversy. IRG 3 thus conducts novel social research on formative nanotech risk and benefit perceptions through a well calibrated set of mixed qualitative and quantitative social science research methods aimed at studying the views and beliefs about emerging nanotechnologies by multiple parties. By 'multiple parties' we mean people in numerous social locations and positions—nanoscale scientists and engineers, nano risk assessment experts, regulators, industry leaders, insurers, NGOs or other social action and special interest groups, journalists, and members of the public who differ by gender, race/ethnicity, class, occupation, education, and age, as well as nation. Thus far, nano R&D has evolved with little evidence of significant public awareness, amplified risk perception, or media attention, and IRG 3 research has moved into more experimental research modes in the context of such continuing low public awareness and low signal amplification. Regulatory action could impact perceived risk quickly and hence is also a vital component of research.

Quantitative methods used in IRG 3 include: standard, psychometric and experimental phone and web surveys of demographically diverse US public and a range of experts including scientists and engineers, regulators, and industry leaders; experimental research on factors driving group polarization in emerging nanotech debate, and tracking of print and internet media coverage of nanotechnologies; qualitative methods provide a substantive basis for and validation of quantitative results and include mental models interviewing, expert interviews, ethnographic interviews, and deliberative public engagement workshops and focus groups regarding the risks and benefits of specific applications of nanotechnologies, in addition to media report analysis. In the past year, researchers in IRG-3 performed work in the main areas detailed below.

New in the coming year:

X-IRG new collaborator Friedman and her Lehigh colleague Egolf will be continuing their study of nano news coverage in print media begun in collaboration with Harvard in 2005, and they will begin exploration of new media nano coverage (e.g., the blogosphere). This research will contribute substantive data on areas of news coverage for all 3 IRGs and special projects. Leading risk perception and public valuation experts Slovic and Gregory from Decision Research will join the effort in IRG 3 and will be working collaboratively on new quantitative research on decision pathways and construction of preference in emergent nanotech risk perception. UCSB collaborator Earl will contribute effort on a new NGO/social movement study.

Integration and synthesis of effort:

IRG 3 effort is a large, complex group, and integration is accomplished through frequent interactions, phone conferences, and meetings among the lead researchers and their teams.

The team has found face to face meetings at least 1-2 times per year essential to the research effort, harmonizing goals and assessing progress across the different projects. Harthorn, Pidgeon & Satterfield are working together on a special edition of *Risk Analysis* that builds on the white papers presented at the Jan 2010 Nano Risk Perception specialist meeting in Santa Barbara and will constitute the first scholarly edition devoted to nanotech risk perception. Harthorn also organized and chaired a panel session at the Society for Risk Analysis meetings in Dec 2010 that built on the CNS-UCSB specialist meeting and reported on its advances. Harthorn is also working with collaborator Mohr on the edited volume, *The Social Life of Nanotechnology*, now under contract with Routledge and due out in late 2011, which integrates IRG 3 public deliberation research with other CNS work.

IRG 3-1: Expert Judgments about Nanotechnologies' Benefits and Risks

Conti, Harthorn, Kandlikar, Satterfield (leaders); Beaudrie, Becker, Bryant, Haldane.

IRG 3-1a: Expert Interviews-NSE

In 2010-11, anthropologist Haldane, an Asst. Prof at Quinnipiac Univ., piloted a new instrument to add a set of new respondents from the US upper northeast nano research world, developed a sample and contacted new NSE research participants in the US Midwest & Northeast to interview. Interviews focus on scientists' ideas about 'responsible development' of nanotechnologies. Haldane is focusing in her work on the *NSE interview data* on aspects of gender and scientific labor, from a cultural analytic perspective. Her chapter (with Bryant and Harthorn) in the CNS *Social Life of Nano* volume explores the interpretive labor of the social scientist in such interviews as an interlocutor for science and society. She plans a series of new interviews in 2011 with NSE women and men in the Northeastern US in centers of NSE intense research to extend the project database. Harthorn, Bryant, and Harthorn continue involvement in this project and are planning joint paper production with Haldane. Key issues include gender differences among experts in risk attenuation (which has potential implications for safety practices in laboratory settings), attitudes toward the public and media (which impact the quality and extent of scientist participation in essential science and society engagement activities), direction of tech development labor toward social goals and responsible practices, and organizational aspects of laboratory practice. This work provides more depth understanding of expert risk perception issues that complements and contributes to findings from a much larger sample in the web survey of experts (below).

IRG 3-1b: Expert Interviews-Regulators

Another component of CNS-UCSB expert study by Conti, an Asst Prof. of Sociology and Law at UW Madison, focuses on ***nano regulators and policymakers***. His prior work with IRG 3 as a key collaborator on both the 2008 public risk perception survey and the 2006 industry EHS survey has attuned him to the protocols and risk perception issues of interest, and his unique background as an expert on international governance provides an extremely useful comparative framework. In June 2010 he relocated temporarily to Washington DC for an extended period to conduct a series of interviews with US nano regulators in which he explored their comparative interagency views on issues of regulating nanomaterials and nano-enabled technologies. This work connects directly to the expert web survey project (**IRG 3-1c**), and the teams have been coordinating closely. In the past year, in addition to conducting a set of interviews with environmental regulators in the US, he has analyzed the literature related to nano-regulation, developed a coding guide for interview analysis, transcribed interviews, completed initial coding, and is preparing a first analysis from interviews with EPA experts.

This work also will interface well with the UBC team's analytic work on ***regulation across the life cycle*** and both studies link well to our collaborative work in the UC CEIN. In 2010, the UBC

team completed a study of regulatory gaps across the life cycle of nanomaterials, led by Christian Beaudrie under the supervision of Kandlikar and Satterfield; this resulted in a commissioned report for the Chemical Heritage Foundation that was released in Sept. 2010. This work identified critical gaps with respect to regulatory coverage across the life cycle of emerging nanotechnologies. These gaps create a regulatory “no-man’s land” and make it difficult for regulatory agencies to collect risk relevant data, and conduct risk analyses for emerging nanomaterials at each stage of their life cycle. The focus on LCA (life cycle analysis) in this work aligns well with rising interests in the nano eco-toxicology world, and Beaudrie and Harthorn participated in a nano LCA workshop at the Bren School, UCSB in Feb., 2011.

Closely, connected to this, the UBC team is analyzing the emergent nano risk assessment context and providing critical analysis of the challenges. For example, they have argued that decision-analytic tools (such as risk-ranking, multi-criteria decision analysis, and control banding) can be adapted to help make decisions about emerging nanotechnologies and nanomaterials. Yet, they note that decision analytic research and tool development is lagging, and will require targeted funding mechanisms (Beaudrie & Kandlikar 2011). Also, they point out that baseline information call-ins for nanomaterials have so far provided scant data to assist in risk assessment (EPA’s NMSP, DTSC’s call-in). However, they argue that both approaches have some merit, with the DTSC call-in benefiting from engagement with companies. They note that confidentiality (CBI—Confidential Business Information) claims are likely to be a significant barrier to collecting risk-relevant data by regulatory agencies, and future information call-ins should be designed carefully with decision-objectives and potential barriers in mind. The team plans an experimental expert workshop in 2011 to address lagging development.

IRG 3-1c: Expert Web Survey—NSE, Nanotox, NanoReg

On a parallel track, the UBC team (Beaudrie, Kandlikar & Satterfield) completed data collection for a Nanoscience Expert Survey in spring/summer 2010, working with the Social Science Survey Center at UCSB in conjunction with Harthorn. The survey was delivered to 2130 nano-experts with 424 responses from nanoscientists and engineers (NSE), nano-EHS researchers (NanoTox), and nanotechnology regulators (NanoReg). Data analysis is in progress, with presentations at SRA (Dec 2010) and UC CEIN (Mar 2011). The study explores experts’ views on physical or technological risks, societal risks and benefits, laboratory practices (where appropriate), and regulatory challenges for nanomaterials (NMs) and nanoenabled products. Preliminary results:

- The expert survey found consistent patterns in risk ranking of nanomaterial release scenarios and product applications across the three nano expert groups, suggesting a general trend and agreement in relative ranking of potential risks. Occupational exposures and environmental releases from production facilities were deemed most risky compared to other release scenarios and specific nano-applications.
- There are significant differences in risk perceptions across domains of nano-expert groups, and across demographics including gender and race. These small but consistent differences in risk judgment once identified, should be taken into consideration and controlled when utilizing expert judgment under conditions of high uncertainty, such as when conducting risk analysis for emerging nanomaterials.
- Experts in regulatory agencies judge risks across a range of nano-application categories to be significantly higher than corresponding judgments of NSE and nano-EHS researchers. Somewhat surprisingly, they are also *more* likely than other groups to agree that US regulatory agencies are inadequately prepared for controlling risks from nanotechnologies across application categories.

This work has strong synergies with IRG 3's public perception work and with our partners in the UC CEIN. In general we anticipate this work will allow us to better understand disciplinary and other contextual differences among the emergent risk assessment community and their counterparts in basic and applied NSE, as well as anticipating points of disjuncture with other stakeholders' views. This work builds on the foundational work of Satterfield's longtime collaborator, Paul Slovic, on the comparative toxicological assumptions of experts and lay persons.

IRG 3-2: Public Participation in Nanotechnology R&D: Upstream Engagement and Deliberation Research

Harthorn, Pidgeon, Bryant, Rogers, Rogers-Hayden, Corner, Cranfill, Denes, Hanna, Martin, Shearer, Whirlow

2007-2009. The first set of CNS-UCSB comparative deliberations in California and the UK was completed in 2007, and extensive data analysis in NVivo was conducted in 2007-08. The first publication on this work came out in *Nature Nanotechnology* in Feb 2009 (Pidgeon et al. 2009). The group continues working on the longer companion piece to this study which explores at greater length the pronounced application-based differences in attitudes, the more subtle but important cross-national differences and surprising similarities, attitudes about trust, responsibility, and regulation, which also vary more intensely by application than by country in this study. The research was designed to allow exploration of more general cultural constructs of the domains of health and energy which we theorize to form an important foundation for emergent views about nanotechnologies in those application areas. The project has the great advantage of reviewing these results in the context of the Cardiff and UEA groups's extensive comparative experience with other nano and non-nano public engagement efforts in the UK, particularly biotech, energy, and, now, geoengineering. This study also provides invaluable comparative data for the subsequent 2009-2010 study, for future analysis. Bryant will be in residence at CNS in Fall 2011 to work with Harthorn (and Pidgeon) on bringing this work to conclusion.

2008-2011. Co-Funding*: To extend this work and follow the very suggestive gender differences in perceived risk that emerged within all the groups in the 2007 workshops, Harthorn (and Bryant) sought and received additional funding from NSF for new research to explore gendered aspects of nanotech risk perception. This study examines gender as a between group effect in 6 deliberative workshops plus one pilot, conducted in California in summer and fall, 2009. Feminist sociologist Rogers, now Asst. Prof. of Sociology at Long Island Univ., was postdoctoral researcher on the project Jan 2009-Aug 2010; sociologist Shearer followed up on a year as fellow on the project by assuming the postdoc position in Sept 2010 on a parttime basis. Additional team members since Fall 2010 include grads Denes, Cranfill, & Hanna and undergrad Whirlow.

Extensive work in the past year has advanced the project significantly, although data analysis and dissemination will continue for through summer 2011. The team completed preliminary preparation of workshop transcripts in May 2010, followed extensive NVivo coding and data analysis on a series of research questions that ask how is deliberative engagement gendered, raced and otherwise driven by differences in identity, personal and professional experiences, and social location? And how do perceptions of technological benefit and risk emerge through gendered dialogue and debate? In specific, the following questions are under analysis:

- how does nano application (energy, health) interact w/ gender in producing views on risks/benefits?
- how do ideas about justice and fairness play out in debating nanotech futures?

- what are public views about nano engineering involving food and food systems? Is there reason to think that nano will follow GM re: public concerns?
- how are public views about nanotechnologies conflicted, ambivalent and uncertain, and how does that vary across social locations and technology applications?

Five publications have been prepared on these issues (3 in press, 2 under review), and a larger piece on the main gender analysis is in analysis, including more focused work on the pre-/post-findings and tracking when, how, and why people's views change or remain fixed in response to new information and group dynamics. In general, the work supports findings from survey work on the highly gendered nature of technological risk perception but is aiming to explicate how, why and through what kinds of narratives and group dynamics such divergent views emerge in public dialogue, as well as the kinds of responses they generate. These are important questions for participatory democracy. Looking ahead, Harthorn began collaboration in 2010 with UCSB feminist political theorist, Edwina Barvosa, to consider how future deliberative engagement research will incorporate a focus on racial/ethnic identity and multiple identities as factors in risk and benefit perception.

In Nov 2010, Cranfill began additional refinement of the deliberation transcripts using her linguistic expertise, and in Jan 2011 the team launched a new set of analyses to examine in a more fine-grained way how talk/communication is gendered and raced? This micro analysis of speech patterns looks at gendered patterns of interruptions, frequency of talking/silence, and their effects on coalition building or conflict and is being developed into a journal article authored by grad fellow Denes, Cranfill and undergrad researcher Whirlow in addition to Shearer and Harthorn.

The team has disseminated findings extensively, at the Society for Applied Anthropology, March 2010 (Rogers et al.), the Pacific Sociological Association Apr 2010 (Rogers et al.), the International Sociological Association (Rogers et al., July, 2010), the Rural Sociological Association (Rogers et al., Aug 2010), S.NET (Harthorn et al., Sept 2010), UCSB Globalizing Risk seminar (Harthorn et al., Oct 2010), NSF NSE meeting (McCray & Harthorn, Dec 2010), UCSB Feminist Studies seminar (Harthorn et al., Feb 2011), and Univ of Washington Cascadia Seminar (Harthorn et al., Mar 2011).

The Cardiff team (Pidgeon & Corner) took on a key writing task for *The Social Life of Nano* edited volume, producing an overview/synthesis of nano public engagement entitled: "Nanotechnologies and upstream public engagement: dilemmas, debates and prospects?" For this work, they created a comprehensive and up-to-date database of all (global) public engagement projects that were documented by either peer-reviewed publications or reports that reflected on data and methodology. The chapter argues that upstream engagement, though challenging in a number of respects, is an important aspect of responsible development. The database is included as part of the chapter and serves as an anchor for CNS discussions in the volume and other venues of the debates around upstream engagement.

IRG 3-3: Emergent Public Perceptions of Benefits and Risks (survey research)

Satterfield, Pidgeon, Harthorn, Kandlikar, Beaudrie, Conti, D'Arcangelis, Corner, Devries, Hanna

IRG 3-3a: Public perceptions, construction of preference

Since Fall 2008, the team has continued analysis and write up of data from the 2008 national survey, preparing a series of papers from this work, focusing on key contextual, experiential, affective, and demographic factors that seem to be driving nanotech perceived risk, perceived benefit, reversals of judgments about risk vs. benefit, and construction of preference. The first of

these on vulnerability and inequality as factors in risk perception has been accepted at *Risk Analysis* (Conti et al., forthcoming), and 2 more are in revision for resubmission. Additional analyses are in discussion in collaboration with UBC, Cardiff, UCSB, and U Wisc. The UK team took the lead on and completed a paper in 2010 on the US 2008 survey data on affect and ambivalence. The working title of the paper is 'Not Yet a Hot Topic: Affect and Nanotechnologies,' and it was submitted to *Journal of Risk Analysis*. It is currently undergoing revision. The UK team is also contributing key effort to the deliberation research, other public attitude survey studies, including environmental risk perception survey research, and research planning for IRG 3 for years 6-10.

In addition the Cardiff team was asked to submit a brief memorandum to the House of Commons Science & Technology Select Committee inquiry on the Regulation of Geoengineering. The Memorandum was submitted, arguing that any investment in the physical science of geoengineering should be pre-empted by investment in social science too – so that public engagement on geoengineering can be as upstream and effective as possible. The memorandum drew explicitly on CNS funded work (Pidgeon et al., 2009: *Nature Nanotechnology* publication) and the field of upstream engagement in nanotechnology more broadly, and Pidgeon was subsequently invited before the Committee (January 2010) to give oral evidence. This work demonstrates the applicability of NNI-funded upstream nano research to other emerging technologies and its potential contributions to regulatory decision making.

Pidgeon collaborated with Baruch Fischhoff (Carnegie Mellon University and the NSF funded Climate Decision Making Centre) on a paper published in the March 2011 issue of *Nature Climate Change* arguing that US scientists should build future strategic capability around risk communication for environmental decision making.

In addition, Pidgeon is the lead editor on the special issue of *Risk Analysis*, currently in preparation with Harthorn and Satterfield. This will be the first edited collection exclusively focused on risk perception research on nanotechnologies. Publication is anticipated for late 2011.

IRG 3 plans for the next 5 years include additional national survey in the US and experimental decision pathway analysis in collaboration with Decision Research. Further planning for these next projects and their coordination will take place at the May 2011 Research Summit.

IRG 3-3b: Environmental Risk Perception Survey

Satterfield, Harthorn, D'Arcangelis, Devries, Hanna, Pitts

Co-funding: Primarily funded through the UC CEIN IRG 7, the team conducted research on environmental risk perception in a dually novel area (specific engineered nanomaterials—ENMs-- as nested in distinct perceptions of different environmental media). In order to accomplish this, the group completed a two-phase design of studying public perceptions of air, water, and soil alone (phase 1) and in interaction with ENMs (phase 2). This was accomplished using a mental models interview design (which seek lay theories of cause and effect, and lay intuitions about harm and safety). Findings from the interviews were then incorporated into a Stage 1 pilot survey instrument. Input from UC CEIN toxicologists and ecologists was used to determine which ENMs to focus on, to ensure scientific validity of the distinctions drawn among them, and to ensure instrument conformity to ecologists' views of environmental media. The pilot survey results are currently in data analysis. A paper on the environmental values from the mental models research is in draft form for planned submission in Spring 2011 (D'Arcangelis et

al.). Selective preliminary findings from the pilot survey on environmental risk perceptions of ENMs by a large pilot sample ($n < 800$) of US public include:

- Reporting that ENMs are present in air, soil, and/or water leads to respondents scoring the ENMs as more difficult to detect and/or measure in the environment (i.e., to touch, feel, see, describe, measure, sample and test). Those who see ENMs as highly intangible are more likely to have higher risk ratings for some materials. *Implications: The very idea of invisible and intangible materials appears to inspire some risk aversion, which might be problematic for science communication.*
- Respondents with higher tested nanotech knowledge were consistently slightly more accepting of specific ENMs than those with little or no knowledge of nanotechnologies, though the differences are modest. *Implications: Despite the above caveats, there is reason to be optimistic about the benefits of scientific literacy from science education & communication, although previous risk controversies have indicated that the knowledge benefit only holds true for risks in the absence of controversy.*
- Respondents who rated the environmental media of air, water, and soil with and without added ENMs as more resilient (i.e., recovering easily from human impacts, self-cleaning over time, mostly pure, easy to control) also tended to see the benefits of various technologies as outweighing the risks, to accept specific nanotechnologies, and to agree with reassuring statements about environmental toxicology. *Implications: Emerging UC CEIN and CEINT research about the actual resilience of environmental media to recover from impacts of ENMs will be salient information in the minds of some public groups, though better demographic distinction this way needs to be developed with a larger, more representative survey.*

Planning and implementation of a stage 2 survey to a larger and more representative sample is planned for Spring-Fall 2011, with more specific ENMs for comparative risk assessment and life cycle features. The CNS IRG 3 collaboration with researchers in the UC CEIN offers an unprecedented opportunity for co-production of risk knowledge by scientists and societal researchers.

IRG 3-4: Industry risk perception study (International survey)

Harthorn, Holden, Satterfield, Conti, Engeman, Baumgartner, Carr, Fish, Meyerhofer

This project, also funded primarily through the UC CEIN IRG 7, aims to assess changes since 2006 in industry EH&S views and practices, studied in our 2006 international survey (Conti et al. 2008) and also add a new dimension of focused risk perception data on industry leaders in order to investigate links between perceived risk and behaviors such as company attention to and following of guidance documents for safe handling of nanomaterials, compliance with voluntary regulatory programs, attention to worker and environmental safety, waste management practices, and consumer safety. The project was run as a Bren School for Environmental Science and Management Masters Group Project, for the MSc degree, with Holden the Bren advisor, Harthorn the 'client' and PI, and sociology doctoral candidate Cassandra Engeman the project coordinator and lead student researcher. Phase 1 of data collection (Bren Group Project) completed a sample of 60 companies that synthesize or handle nanomaterials in Jan 2010, and a phase 1 report in March 2010. Additional data collection by Engeman and Baumgartner extended the sample to a final n of 78 companies by Jun 30, 2010. Satterfield has provided extensive consultation regarding the novel risk perception portion of the instrument and data analysis for those data.

The industry survey project is of significant interest to NSE, industry and regulators, as well as NGOs and publics, and the team has made numerous presentations to date outside of social

science venues, e.g., Engeman to a major Japanese industry meeting in Feb 2010, Engeman and Baumgartner to an industry and academic consortium Mar 2010, Harthorn to a NSF Nano2 Revisioning conf and a NNCO EHC Capstone meeting in Mar 2010 and a NIOSH OHS meeting July 2010 and Holden to a California DTSC meeting in Oct 2010. The project is currently preparing the first publication from the project for submission in early Spring 2011.

IRG 3-5: Variation in the Framing of Nano.

Bimber, Lively, Conroy, Weaver; Friedman, Egolf

In 2009, the group published (Weaver, Lively & Bimber 2009) an analysis of news trends over time in coverage of nanotechnology, focusing on the following questions. 1) How has news volume changed over time and in response to what events? 2) What are the most common news frames in stories about nano? 3) With which news outlets are these associated? They followed up on that project with continued news tracking of nano coverage through 2009, with more news outlets, and with an added analytic focus: which specific applications of nanotechnologies (e.g. energy, computing, medicine, consumer products) are associated in news coverage with which news frames. The team prepared a chapter for the UCSB-CNS edited volume (Lively et al.) reporting the results of this project, concluding this project.

Moving forward, the study of media framing of nano will be taken up by science journalism experts Friedman and Egolf at Lehigh Univ. who have developed an extensive coding system for analyzing print media coverage of nano and will be exploring methods for studying on-line coverage in a valid and reliable fashion. Friedman supplements the print media report analysis with depth interviews with journalists to provide depth understanding of the changing media environment for risk reporting and communication of scientific uncertainty.

IRG 3-6: Anchoring Effects in Judgments about Public Policy.

Bimber, Lively, Conroy

Studying nanotechnology in the public sphere provides an unusual opportunity to observe the political system responding to a novel or apparently novel issue. Most important from the group's perspective is the hypothesis that no dominant frames and categories advanced by media have yet shaped how the public thinks about nano. This provides a useful opportunity to examine some theoretical questions regarding how people think about novel political objects, and how their thinking is shaped by framing. We have developed a theoretical framework combining research in psychology on cognitive biases with theories of framing in political science and communication. Our theory involves "anchoring effects," which are a well-known phenomenon by which an arbitrarily given number affects a recipient's judgment in a later quantitative task. We extrapolate to judgments about risk comparisons not involving explicit quantitative judgments, and we suspect that apparently innocuous comparisons between nano and other technological products may produce an anchoring effect or a contrast effect in the ways that people judge nano, and well as how they reason among other comparisons of public issues.

The group completed an experimental survey with about 700 subjects in 2010, using Knowledge Networks as a subcontractor. The results show substantial contrast effects: that is, subjects primed first to think about a technological issue or other public problems tend to view a second, target issue or problem in contrast to the priming issue. Exposure shifts opinion away from the priming issue, compared with subjects not so exposed. The results of this project are under journal review.

IRG 3-7: The Politics of Consumer Choice.Bimber, Copeland, Conroy

Research shows an increase in recent decades in political consumption across Europe and in the US: that is, instances where consumers make choices in the marketplace that partially reflect political, ethical, or social concerns. Boycotting or “buycotting” are reported by about 30% of Americans each year. This phenomenon is not well understood, especially the circumstances under which these acts represent risk-avoidance as opposed to environmental or ethical choices involving public goods problems. It is entirely unclear, moreover, how the rise in political consumption might affect consumer products with nanotechnology in them. This project will involve a national survey of citizens, examining the attributes and attitudes associated with political choices in the marketplace, and will examine how people who engage in political consumption respond to questions about nano-related products. The survey will be fielded in late summer of 2011. Results from this study will be integrated with those of projects IRG 3-3.

IRG 3 Co-funding:*Leverage:**

- 1) Harthorn (NSF SES-0824042), “Deliberating Nanotechnologies in the US: Gendered Beliefs about Benefits and Risks as Factors in Emerging Public Perception and Participation,” 2008-2011. Rogers was a postdoc researcher for 1.5 years; CNS fellow Shearer completed her PhD and took over the postdoc role, parttime, in Sept 2010, Martin, Hanna, and Denes were/are CNS fellows who contribute effort on this project. Cranfill and Whirlow are student researchers on this project.
- 2) Nel, Andre et al. (NSF EF-0830117), “UC Center for Environmental Implications of Nanotechnology,” Harthorn is IRG 7 (“Environmental Risk Perception”) leader, Co-PI of the UCSB subcontract, and member of the UC CEIN Research Executive Committee, 2008-2013; Satterfield and Kandlikar are IRG 7 senior personnel; Freudenburg was senior personnel until his untimely death in Dec 2010. The IRG 7 UC CEIN funding allows CNS IRG 3 to extend its research on expert views and public perceptions to more specifically environmental issues. The IRG 7 funding in the UC CEIN provides funds for public survey research on nano environmental risk perception (postdoc D’Arcangelis; UBC research assistant Devries; UBC postdoc Pitts), and the 2009-2010 international industry survey (GSRs Engeman, Baumgartner, Carr, Fine, Meyerhofer) both of which build on prior CNS research and contribute to ongoing and future efforts; since Fall 2010, Engeman is supported by a CNS SS fellowship, providing substantial IRG 3 funding supplement to the industry survey project.
- 3) Conti has prepared and submitted an NSF proposal for additional funding for his nano regulator study; has secured intramural funding at Univ. of Wisconsin that is supporting a student researcher and partially supported his research travel in 2010 on this project.

IRG 3: Publications and Presentations in 2010-2011

IRG 3’s work is maturing into a rich publication portfolio of interlinked pieces, with many more in planning than are listed here. In 2010-2011 we have published, forthcoming or under review 31 articles, chapters, books, white papers and a dissertation, with many more publications in preparation. Publications reflect the group’s aim to produce scholarly work of high quality within social science disciplines but also to reach out to NSE audiences and policymakers and others concerned with emerging nanotechnologies, risk communication, and responsible development.

The group has disseminated findings widely, to a range of disciplinary, NSE, industry and policy audiences. IRG 3 has a robust program of dissemination in scholarly disciplinary and

interdisciplinary setting by all project participants, as reflected in the 37+ presentations listed below, and the leadership role taken in organizing and chairing panels and sessions at a number of venues (S.NET, AAA, NanoEquity, NSE PI, Nano2). Project senior personnel also increasingly draw across the different projects and research areas, synthesizing implications of the findings for interdisciplinary risk perception and public deliberation studies as well as more focused nanotechnology public response and debate issues.

IRG 3's research is of particular interest to governments and policymakers. For example, in Jan 2010 Pidgeon gave evidence to the UK House of Commons Science and Technology Committee inquiry on the regulation of geoengineering, drawing extensively on examples from nanotechnology for public engagement and regulatory gaps analysis. Harthorn has made a series of national and international presentations and provided testimony and evidence incorporating findings from these studies, for example on a panel of the PCAST working group reviewing the NNI in Feb 2010, as moderator and presenter in the Societal Implications panel at the Nano 2 NNI Revisioning conference in Mar 2010, as a keynote speaker at the NNCO Capstone conference in Mar 2010, and at the NIOSH Nano Worker Safety conference in July 2010. Engeman and Baumgartner (April 2010) and Holden (Oct 2010) have presented to California Department of Toxic Substance Control audiences.

Publications 2010-2011

1. Christian Beaudrie. 2010. *Emerging Nanotechnologies and Life Cycle Regulation: An investigation of federal regulatory oversight from nanomaterial production to end of life*. Chemical Heritage Foundation. 53pp.
2. Barbara Herr Harthorn. 2010. "Public participation in nanotechnology – should we care?" *Op ed on 2020 Science*, May 4, 2010. <http://2020science.org/2010/05/04/publicparticipation-in-nanotechnology-should-we-care/>
3. Mihail Roco, Barbara Harthorn, David Guston, and Philip Shapira. 2010. "Innovative and responsible governance of nanotechnology for societal development. Ch. 13." In *Nanotechnology Research Directions for Societal Needs in 2020*, Ed. M. Roco. Springer.
4. Richard Applebaum, Bruce Bimber, and Barbara Herr Harthorn. 2010. SBE 2020 White paper. Published on-line at http://www.nsf.gov/sbe/sbe_2020/all.cfm
5. 5-7. Harthorn, Barbara Herr. (2010). Entries. In David Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanotechnology* ("Gender and Nanotechnology": 269-271; "Amplification of Risk": 669-670; "Attenuation of Risk": 671-672). London: Sage Publications.
- 8-10. Rogers, Jennifer. (2010). Entries. In David Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanotechnology and Society* (pp. "iPod Nano": 363-364; "Friends of the Earth": 261-262; "Center for Nanotechnology in Society-UC Santa Barbara": 80-82.). London: Sage.
11. Meredith Conroy. 2010. "A Psychology of Framing: The Effects of Personality on Susceptibility to Media Frames," Doctoral dissertation, Department of Political Science, University of California at Santa Barbara, December.
12. Barbara Herr Harthorn. 2011. "Methodological Challenges Posed by Emergent Nanotechnologies and Cultural Values." In *The Handbook of Emergent Technologies and Social Research*, pp. 65-88. Eds. Sharlene Nagy Hesse-Biber. Oxford University Press.
13. Barbara Herr Harthorn, Jennifer Rogers, Christine Shearer, and Tyronne Martin. "Debating Nanoethics: U.S. Public Perceptions of Nanotechnology Applications for Energy and the Environment." In *Debating Science: Deliberation, Values, and the Common Good, Second Edition*, Eds. Dane Scott and Blake Francis. Prometheus Books (forthcoming, 2011/2012).

14. Barbara Herr Harthorn, Christine Shearer, and Jennifer Rogers. 2011. "Constraints on Benefit of New Technologies for the World's Poor: A View from the North on Fairness." In *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Eds. Rachel Parker and Richard Appelbaum. Routledge. (forthcoming, 2011/2012).
15. Jennifer Rogers and Amy Zader. 2011. "Food Security: From the Green Revolution to Nanotechnology." In *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Eds. Rachel Parker and Richard Appelbaum. Routledge (forthcoming, 2011/2012).
16. Christian E. H. Beaudrie and Milind Kandlikar. 2011. "Horses for Courses: Risk Information and Decision Making In the Regulation of Nanomaterials." *Journal of Nanoparticle Research* (IN PRESS – Advance Online).
17. Christian E. H. Beaudrie, Milind Kandlikar, and Gurumurthy Ramachandran. "Using Expert Judgment for Risk Assessment." In *Assessing Nanoparticle Risks to Human Health*, Ed. Gurumurthy Ramachandran. Elsevier (forthcoming 2011).
<http://www.springerlink.com/content/k45528766006522v/>
18. Nick Pidgeon and Baruch Fischhoff. 2011. "The Role of Social and Decision Sciences in Communicating Uncertain Climate Risks." *Nature Climate Change*, V1(1) (March).
19. Joseph Conti, Terre Satterfield & Barbara Harthorn. "Vulnerability and Social Justice as Factors in Emergent US Nanotechnology Risk Perceptions." *Risk Analysis* (forthcoming).
20. Barbara Herr Harthorn and John Mohr. Eds. *The Social Life of Nanotechnology*. Routledge, (forthcoming 2011).
21. Barbara Herr Harthorn and John Mohr. "Introduction: The social scientific view of nanotechnologies." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge (expected 2011/2012).
22. Jennifer Rogers, Christine Shearer, and Barbara Herr Harthorn. "Situating Nano in the social world," forthcoming in *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge (expected 2011/2012).
23. Hillary Haldane, Karl Bryant, and Barbara Herr Harthorn, "Expertise and Expectations: The Role of Gender in Expert Perceptions of Emergent Nanotechnologies." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (expected 2011/2012).
24. Adam Corner and Nick Pidgeon. "Nanotechnologies and Upstream Public Engageent: Dilemmas, Debates and Prospects?" In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (expected 2011/2012).
25. Erica Lively, Meredith Conroy, David Weaver, and Bruce Bimber. "News media frame novel technologies in a familiar way: Nanotechnology, applications and progress." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (expected 2011/2012).
26. William Freudenburg and Mary Collins. "Recreancy and Nanotechnology: A Call for Empirical Research." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (expected 2011/2012).
27. Bruce Bimber, Meredith Conroy, and Erica Lively. "Comparison Effects in Judgment about Public Issues." (Under review).
28. Jennifer Rogers, Christine Shearer, and Barbara Herr Harthorn. "Debating Nano/Bio Technological Alteration of Food: Public Deliberation and Cultural Logics." *Environment and Society*. (Under review.)
29. Barbara Herr Harthorn, Christine Shearer, and Jennifer Rogers. "Exploring Ambivalence: Techno-Enthusiasm and Skepticism in US Nanotech Deliberations." *Society for the Study of Nanoscience and Emerging Technologies*, Ed. Torben Zuelsdorf. (Under review).

30. Adam Corner, Nick Pidgeon, Terre Satterfield, and Barbara Harthorn. "Affective ambivalence and nanotechnologies." *Journal of Risk Research*. (Under review).
31. Terre Satterfield, Joseph A. Conti, Barbara Herr Harthorn, Nick Pidgeon. "Early Warnings across Malleable Perceptions of Nanotechnologies: Risk, Benefit, Betrayal and Trust." (Under review).

In preparation

1. John Mohr and Barbara Herr Harthorn, "Conclusion: What Can the Social Sciences Tell Us about the Future of Nanotechnology in Society?" In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr. Routledge (expected 2011/2012).
2. Nick Pidgeon, Barbara Harthorn, and Terre Satterfield, Eds., special issue of *Risk Analysis, Nanotechnology Risk Perception*, from the Jan 2010 risk perception specialist meeting.
3. Joseph A. Conti and Sean Becker. "Perceived Risks of Nanotechnology and the Regulatory Judgments of US Environmental Regulators." Manuscript in preparation.
4. Terre Satterfield, Joseph Conti, Nick Pidgeon, and Barbara Herr Harthorn. "A Fine Balance: Risk, Trust, and the Potential for Stigma in Emerging Perceptions of Nanotechnology." Manuscript in preparation.
5. Cassandra Engeman, Lynn Baumgartner, Benjamin Carr, Allison Fish, John Meyerhofer, Patricia Holden, and Barbara Herr Harthorn. "Risk and Safety in the International Nanomaterials." Manuscript in preparation.
6. Gwen D'Arcangelis, Laura DeVries, Terre Satterfield, and Barbara Herr Harthorn. "Cultural models of environment and hazard in the US and Canada: Exploring emergent views on engineered nanomaterials." In preparation for submission to *Environment & Society*.

IRG 3 Presentations 2010-11

1. Satterfield and Kandlikar. "Reflections on Chasing the Elusive: Hope, Intention and Disruption in the Anticipation of Social Response to Nanotechnologies," University of British Columbia, March 2, 2010.
2. Engeman and Baumgartner. Video conference presentation of preliminary findings to the Nanotechnology Colloquium, a bi-weekly meeting of industry and academics on the issue of nanotechnology; invited to speak by Applied Nanotechnology, Inc. in Austin, TX, March 8, 2010.
3. Harthorn. "The Past and Future of Responsible Development for Nanotechnologies," Session 13, Societal Dimensions of Nanotechnology at NNI Revisioning Nano2 conference, Evanston, IL, Mar 9-10, 2010.
4. Rogers, Harthorn, Shearer, and Martin, "Engaging the Citizenry: US Publics' Values and Perceptions Regarding Emerging Nanotechnologies for Energy and the Environment," Society for Applied Anthropology Annual Meeting. Merida. March 24-27, 2010.
5. Harthorn, "How Nanotech Risk Perception Informs EHS Decision Making" Keynote address, NNCO EHS Capstone conference, Washington DC, March 30-31 2010.
6. Baumgartner, Carr, Fish, and Meyerhofer, Final Project Presentation, Bren Masters Group Project—Industry Survey of Environmental & Safety Practices in the Nanomaterials Industry, Santa Barbara, CA, April 8, 2010.
7. Engeman and Baumgartner. Industry survey, presentation of preliminary findings, UCSB CEIN in conjunction with DTSC personnel visit, Santa Barbara, CA, April 15, 2010.
8. Rogers, Shearer, and Harthorn "Will Nano Be the Next GM? Public Perceptions, Reactions and Movements," Pacific Sociological Association, Oakland, CA, April 8-11, 2010.
9. Engeman. Santa Barbara Earth Day. Industry survey presentation on preliminary findings. Faulkner Gallery, Santa Barbara Public Library, CA, April 24, 2010.

10. D'Arcangelis, DeVries, Satterfield, and Harthorn. "'Mental models' of environmental risk perception: public response to nanomaterials." Poster at CNS site visit, Santa Barbara, CA, May 4, 2010.
11. D'Arcangelis, DeVries, Satterfield, and Harthorn. "Environmental Risk Perception: Surveying Public Response to Nanomaterials." Poster at ICEIN conference, UCLA, May 11-13, 2010.
12. Beaudrie, "Risk and Nanomaterial Regulation: A Life Cycle Investigation of Federal Health and Environmental Regulations," ICEIN Conference, UCLA, Los Angeles, CA, May 11, 2010.
13. Engeman and Baumgartner. "Survey of International Nanomaterials Industry EH&S Practices and Perceptions," ICEIN, UCLA, Los Angeles, CA, May 11-13, 2010.
14. Engeman and Baumgartner. "Survey of International Nanomaterials Industry EH&S Practices and Perceptions," UC CEIN site visit, UCLA, Los Angeles, CA, June 15, 2010.
15. D'Arcangelis, DeVries, Satterfield, and Harthorn. "Environmental Risk Perception: Surveying Public Response to Nanomaterials." UC CEIN site visit, UCLA, Los Angeles, CA, June 15-16, 2010.
16. Beaudrie. "Risk and Nanomaterial Regulation: A Life Cycle Investigation of Federal Health and Environmental Regulations" Greener Nano 2010 Conference, Portland, OR, June 16, 2010.
17. Engeman, Baumgartner, Holden, and Harthorn. "Reported practices and perceived risks related to health, safety and environmental stewardship in nanomaterials industries." Paper International Sociology Association World Congress, Gothenburg, Sweden, July 10-17, 2010.
18. Rogers, Harthorn and Shearer. "Visions of Nanotech Futures: A Feminist Analysis of Nanotechnology Deliberative Workshops," International Sociological Association, Gothenburg, Sweden. July 15, 2010.
19. D'Arcangelis. "Public risk perception of environmental risks of ENMs." CNS Research Seminar, Santa Barbara, CA, July 28, 2010.
20. Rogers, Shearer, and Harthorn. "Deliberating Risks: Public Perceptions Regarding Nano Food and Agricultural Applications," Rural Sociological Association, Atlanta, GA, August 15, 2010.
21. Harthorn, Rogers and Shearer. "Paradoxes of Development: Techno-Enthusiasm and Skepticism in US Nanotech Deliberation," Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, Sept 29-Oct 2, 2010.
22. Holden. "UCSB Nanotechnology Industry Survey Overview: Nanomaterial Eco-toxicology Impacts," Nanotechnology VI: Progress in Protection conference organized by the California Department of Toxic Substance Control (DTSC), UCLA, Los Angeles, CA, October 13, 2010.
23. Harthorn. "Ambivalence, uncertainty & risk: Public engagement with new [nano]technologies," Inaugural faculty lecture, Globalizing Risk UCSB Faculty Lecture Series, American Cultures & Global Contexts, University of California at Santa Barbara, CA, Oct. 22, 2010.
24. D'Arcangelis. "Public risk perception of environmental risks of ENMs and environmental justice," National Women's Studies Association, Denver, CO, Nov 12, 2010.
25. Beaudrie. "Lessons Learned from a Survey of Nanotechnology Experts", RMES 500s, Qualitative Methods in Interdisciplinary Contexts, University of British Columbia, November 17, 2010.
26. Harthorn. "Risk perception and environmental health and safety practices in the global nanomaterials industry." Environmental Studies/Anthro 130, Coupled Human and Natural Systems, UC Santa Barbara, CA, Nov. 10, 2010.

27. Engeman. "Reported Practices and Perceived Risks Related to Health, Safety, and Environmental Stewardship in Nanomaterials Industries," CNS seminar series (Soc 591 BH), UCSB, CA, November 17, 2010
28. Beaudrie. "Technology and Sustainability?" Institute for Resources, Environment and Sustainability Student-Led Seminar Series, University of British Columbia, November 30, 2010.
29. Harthorn, Pidgeon, and Satterfield. "What's New about nano? Nanotechnology risk perception specialist meeting Jan 2010." Society for Risk Analysis, Salt Lake City, UT, Dec. 5-8, 2010.
30. Satterfield, Harthorn et al. "Exploring the Prehistory of Risk Perceptions: Malleable Perceptions and Upstream Study of the Perceived Risks of Nanotechnology, Annual Meeting of the Society for Risk Analysis," Salt Lake City Convention Center, UT, December 8, 2010.
31. Satterfield, Pidgeon et al. "Affective Ambivalence and Nanotechnologies," Annual Meeting of the Society for Risk Analysis, Salt Lake City Convention Center, UT, December 8, 2010.
32. Beaudrie, Satterfield, Kandlikar, and Harthorn. "Benefits, Risks, and Regulation of Nanomaterials: Results from an Expert Survey," Society for Risk Analysis Annual Meeting, Salt Lake City, Utah, December 5-8, 2010.
33. McCray and Harthorn. "New methods for public and other stakeholder participation," NNI and Societal Impact session, NSF Nanoscale Science & Engineering Grantees Conference, Arlington, VA, Dec. 8, 2010.
34. Conti. "The Regulation of Nanotechnologies: Regulators, Risk, and Global Governance." University of Wisconsin School of Law, January 25, 2011.
35. Beaudrie (discussant). "Risk Assessment and Nanomaterial Regulation: A life cycle investigation of federal health and environmental regulations" Life Cycle Assessment of Nanomaterials Workshop, UC Santa Barbara, CA, February 7, 2011.
36. Harthorn. "Focus Groups and Deliberation" Guest presentation, Fem St 260 Feminist Research Methods, Feb 9, 2011.
37. Harthorn. "Health Enhancement and Hazard Posed by New [Nano]Technologies." Keynote at Cascadia Seminar: Ethnographic Adventures in Medical Anthropology, Univ. of Washington, Seattle, Mar 4-6, 2011.

IRG 3 Meetings/Outreach to NSE, Nanotox, industry, policymakers, publics/Engagement:

1. Engeman and Baumgartner. Video conference presentation of preliminary findings to the Nanotechnology Colloquium, a bi-weekly meeting of industry and academics on the issue of nanotechnology; invited to speak by Applied Nanotechnology, Inc. in Austin, TX, March 8, 2010.
2. Harthorn. Rapporteur for Session 13, Societal Dimensions of Nanotechnology at NNI Revisioning Nano2 conference, Evanston, IL, Mar 2010.
3. Harthorn. Keynote address at NNCO Capstone conf on EHS issues for nano, Wash DC, Mar 30-31, 2010.
4. Engeman and Baumgartner. Industry survey, presentation of preliminary findings, UCSB CEIN in conjunction with DTSC (Cal EPA) personnel visit, Bren School, UC Santa Barbara, CA, Apr 15, 2010.
5. Engeman. Santa Barbara Earth Day. Industry survey presentation on preliminary findings and environmental implications, Faulkner Gallery, Santa Barbara Public Library, April 24, 2010.
6. Harthorn. Keynote address at NIOSH Nanotech OHS & Medical Surveillance conf., Keystone, CO, July 21-23 2010.

7. Davis. "Regulating Emerging Technologies to Protect Workers, Communities and the Environment." IRG 3 hosted seminar by Silicon Valley Toxics Coalition, UC Santa Barbara, CA, Dec. 1, 2010.
8. Harthorn. Service on UC CEIN Exec Comm, IRG 7 leader—frequent meetings, activities throughout the reporting period in ecotoxicology center.
9. Holden. "UCSB Nanotechnology Industry Survey Overview: Nanomaterial Eco-toxicology Impacts" at the Nanotechnology VI: Progress in Protection conference organized by the California Department of Toxic Substance Control (DTSC), October 13, 2010.
10. Harthorn. Participation on Committee on Opportunities in Science (COOS), AAAS, Feb 2011 AAAS meeting in Washington DC.

CNS X-IRG projects and Special Projects

C. Newfield , Project leader	English/American Studies	UC Santa Barbara
G. Barnett	Technology Transfer	Unit of Washington
D. Boudreaux	Commercialization	Boudreaux and Associates
B. Egolf	Science journalism	Lehigh Univ
S. Friedman , Project leader	Science journalism	Lehigh Univ
M. Goodchild	Geography	UCSB
B. Harthorn	Feminist Studies/Anthro	UCSB
J. Mohr	Sociology	UCSB
D. Mowery	Economics	UC Berkeley

2 Postdocs

M. Johansson	Anthropology	CNS (through Dec 2010)
S. Frederick	Business, GVC, GIS	CNS/Duke Univ

2 Grads, 1 Undergrad, 1 Professional staff

P. Hovey	Media Arts & Technology	UCSB
Z. Horton	English	UCSB
K. He	Biology	UC Berkeley
L. Danilewsky	Conference assistant	Institut d'Etudes Politiques

CNS X-IRG-1 The Social Life of Nanotechnology

[Barbara Harthorn](#), [John Mohr](#) IRGs 1, 2 & 3 & X-IRG

The Social Life of Nanotechnology is an edited volume contracted to Routledge, anticipated publication by late 2011/early 2012. *The Social Life of Nanotechnology* starts from the basic premise, developed throughout the text, that nanotechnologies have an under-theorized and often invisible social life that starts with the very concept of “nanotechnology” itself which, as we show in the volume, takes on a wide range of socio-historically specific meanings around the globe, across multiple localities, institutions and collaborations, through diverse industries, research labs, and government agencies and on into a variety of discussions within the public sphere itself. The volume looks at this process through the lenses of the social and cultural sciences, revealing a surprisingly complicated social milieu where a series of traditionally modernist scientific projects have been (and are continuously being) re-assembled into new configurations that are sharply marked by their emergence within a rapidly changing, increasingly globalized, and decidedly postmodern world. As the authors in this volume explain, this results in a series of unique contradictions, tensions and unexpected developments. We highlight three dimensions of this process in the papers collected here: the early origins of nanotechnologies, questions about the social (and political) organization of the field, and studies concerned with the cultural and subjective meanings ascribed to nanotechnologies in social settings.

* * *

X-IRG-2 Ethnographic Explorations of Nanoscience and Nanotoxicology Laboratories

Mikael Johansson (supervised by [McCray](#) and [Harthorn](#)), IRG 1, IRG 3

During 2010 Johansson started analyzing the extensive ethnographic field data collected the previous year. He started to write a book about the life worlds of nanoscientists and toxicologists studying the adverse effects of nano particles. During the year he got two chapters accepted for publication and work to finish those pieces. In Dec 2010 Johansson ended his two year postdoc and returned to Sweden to his position at the Gothenburg University.

* * *

X-IRG-3 Spatial Analysis and the Global Value Chain for Nanotechnology/Nano in California

Stacey Frederick (supervised by Gereffi, Appelbaum, Harthorn & Goodchild), IRGs 2-3

This project entails value chain mapping of California and the United States in the global nanotechnology economy. Objectives include (1) identifying firms working in each stage of the supply chain from nanomaterials through end-markets, (2) analyzing the impact of value chain dynamics in each stage such as policies, risk, perception, and competitiveness factors, and (3) evaluating how these are linked together in California and how California compares to competing geographies. Outcomes will include a California in the Nanotechnology Global Economy website.

Two preliminary website templates have thus far been created: one for the value chain research framework, and the other designed to provide a framework for carrying out the California in the Nano Global Economy project. To accomplish these goals, Frederick has been reviewing existing data mining and mapping methodologies to determine their applicability to nanotechnology publications, patents, funding sources, and firms. The ultimate goal is to identify ways to link this information to the value chain framework, enabling users to visualize the results. Existing visual mapping programs, and their associated costs, are being examined. (For an example of what we are striving for, see the North Carolina in the Global Economy website, which Frederick developed.) Frederick has also met with organizations involved in the North Carolina nanotechnology industry, to discuss possible synergies between efforts in NC and the California project. Finally, she is also developing an inventory of nanoproducts, and will coordinate this effort in the future with Lenoir and Herron.

This project is should be completed by the end of the calendar year, and then maintained throughout the life of CNS. We are considering expanding it to all nano products (not just those associated with California).

* * *

X-IRG-4 Nanotech in the Media - *New in the coming year*

Sharon Friedman, Brenda Egolf IRGs 1,2& 3, X-IRG

X-IRG new collaborator Friedman and her Lehigh colleague Egolf will be continuing study of nano news coverage in print media begun in collaboration with Harvard in 2005, and they will begin exploration of new media nano coverage (e.g., the blogosphere). This research will contribute substantive data on areas of news coverage for all 3 IRGs and special projects.

* * *

X-IRG-5 States of Innovation

Christopher Newfield, Daryl Boudreaux, Zach Horton

This project examines the impact of the current US innovation system on nanoscale research. As noted in past reports, our strategy has been to analyze the deep structures of nanoscale research within the U.S. innovation system. The group offers unique perspectives in several ways: by linking the study of societal implications to underlying scientific detail; by integrating qualitative and quantitative methods; by linking the micro, meso, and macro-levels of this system; by focusing on the role of university-based technology transfer as a crucial mechanism of nanoscale innovation; by comparing the US system to selected national systems abroad; and by incorporating a fourth level that we call *innovation culture* into our analysis of nanoscale innovation. Our goal is to improve linkages between nanoscience and nanotechnology (NST) and the larger intellectual currents that are transforming public attitudes towards science, the adoption of technology, and the meanings of upstream and downstream engagement. Our research offers insights about innovation from the humanities and social sciences to science practice; conversely, much of our publishing brings research on nanoscale innovation to audiences in arts, letters, and media studies that are generally out of reach of the NSF. Some of our work is experimental and high-risk, with potential for original perspectives where these methods succeed.

The year's principal work was organized around a conference, called 'States of Innovation,' held in Lyon, France, that convened a group of international scholars to analyze the strengths and weaknesses of the national innovation systems of the United States, European Union, and Japan. The remainder of the year focused on several overall activities: integrating the results of our group's previous research into a new model of innovation, making the results of the conference available on the web and elsewhere, and writing a book that is not simply a collection of papers from the conference, but a synthesis of its findings for a broader audience.

3-day Workshop, Lyon, France: "States of Innovation: Research Policy and Practice After 10 Years of the National Nanotechnology Initiative."

The research stream on "**Cultures of Innovation**" is one of the main inspirations behind the Lyon workshop, and two of its publications appeared this year. The hypothesis is that research developments need to have a basis in everyday cultural practices and social innovation in order to have sustained social and economic impact. The workshop's occasion was the 10th anniversary of the American National Nanotechnology Initiative, arguably the federal government's flagship technology endeavor in the post-Cold War period. It reflected a consensus about technology-fueled economic growth, and incorporated established ideas about the importance of intellectual property rights, impact measurements, research funding, university-based technology transfer, and science-society relationships. The workshop was convened to ask, Where does this innovation model currently stand? Are variants in Europe and Asia more successful? What does a decade's innovation research tell us about new approaches and needed reforms?

A global array of analysts and participants came together to take stock of recent innovation research and practice, to share problems and solutions, and to discuss where policy should go. The sessions made particular reference to the national innovation systems of the current science and technology leaders (the United States, the European Union, Japan, and Singapore), of emerging players (India), and of countries that could reposition themselves by adopting innovations policies in arenas such as nanotechnology and renewable energy (Egypt).

The workshop was organized into five topical sessions.

The Changing Roles of Intellectual Property

Science and Innovation Policies in Historical Perspective
Nanoscale Developments and Development Processes
Innovation Systems at the Crossroads: Comparative International Conditions
Research and Innovation Processes in Society

One intended outcome was a delineation of policy and strategic suggestions that will be published for broad audiences. Our work has particular urgency in the context of economic, social, and environmental challenges facing the world after the current financial, economic and social crisis.

During the three days of discussion and debate, three major themes emerged: the ongoing domination of the oft-critiqued but never replaced linear model of innovation, uncertain if not declining levels of innovation in the wealthy countries, and to need to redevelop national innovation systems in open international collaboration.

A number of participants observed that in policy practice, each phase of the research and development process remains driven largely by its own institutional systems and internal cultures. Laboratories operate at a great remove from social concerns, regardless of the opinions of individual scientists. The technology transfer process remains a property-based transaction between parties acting out of public view: the result is an enormous, subterranean pool of confidential agreements in which technology pathways have disappeared from public view. Development decisions are made by executives necessarily thinking of returns to their firm rather than to society. The public generally lacks the expertise, the time, the training, and the general encouragement required to involve itself in any of the previous stages of research or development. The widespread individual interest among scientists and technology administrators in broader concerns, such as improving public health or reversing global warming, does not translate into a change in collective innovation behavior. The social commitments of individuals and specific organizations are entirely compatible with support for a linear R&D process. Determinate decisions occur upstream in a process that, for society as a whole, remains hidden from view.

Other papers described the way that innovation is necessarily non-linear in practice, and rests on reciprocal interactions among users and designers, government funders and researchers, research managers and principal investigators, graduate students and staff technicians, among many others. But the world's most developed national innovation systems (NISs) treat these non-linear interactions as non-systemic, confining their effects to local domains or to small or outlier groups. This reduces the impact of these exchanges on the overall system. When such interactions remain largely within their section of the innovation pipeline, or remain marginal to overall R&D, most of what is learned remains local or proprietary. Overall learning accumulates more slowly than it otherwise would. No section has much effect on any other, in large part because its life-worlds are closed and communication is infrequent. Effective overall innovation might well depend on the mutual visibility of the cultures of each part of the innovation process – of the innovation “ensemble,” the semi-organized, self-transforming network of institutions that produce our innovation outcomes. And yet communication among laboratories, firms, universities, non-governmental organizations, social activists, consumers, and many other agents are currently episodic and narrow, and as a result are generally guarded and mutually suspicious. The Lyon conference at various points imagined “broadband” interaction between, for example, chemical sensor experts and a poor community on the outskirts of Marseille that needed instruments and methods for testing for radioactivity in the local water. What would happen if communication among the various segments of the innovation cycle went “broadband,” and interacted fully and clearly rather than in the short, semi-random bursts that

we have now? What would happen if societal dimensions were richly and continuously present in all “prior” stages of the R&D process, rather than represented by small-scale or artificial mechanisms like focus groups, industry or university publicity, and the circulation of specific individuals?

The Lyon conference was broadband in this sense. Scholars and practitioners from very different innovation cultures communicated with unusual directness. They created a remarkably energizing exchange, and we hope that the book communicates some of this unique atmosphere. The presentations both analyzed the interaction among various segments of the innovation process and *enacted* that fuller exposure and mutual explication that the social turn in innovation theory has long been calling for. The result was unusual pleasure -- and glimpses of an effectiveness of collaboration that is not generally associated with the innovation mechanisms that our societies work with today.

The conference proceedings were taped. The working group made digital files of the papers and debates, and posted these on Newfield’s innovation center website (<http://innovate.ucsb.edu>). We have nearly completed the assembly of a book manuscript, which has been accepted for review by a major university press. The book will have twenty chapters.

The overall book manuscript is being shaped to be read as a continuous argument. It will not be a fully unified argument, as the book retains the differing emphases and in some cases the disagreements about the next-generation innovation model that we would like to see replace that model currently dominating science policy in the US, EU, and Japan. The core features of the alternative model nonetheless emerge from this narrative. This is a model that, as noted above, includes the need for ongoing negotiations among both its conceptualizers and its interested parties in laboratories, government agencies, industry, NGOs, and the public at large. The book is designed to offer both authors and readers a bit of open territory with which to think outside of traditional professional restraints, even as the professional standards structuring the research remain functional and visible in the final work. The book will do what books – as opposed to journal articles and Internet web sites— do best, which is to offer a sustained, challenging, continuous, powerful argument, one not too long to be read as a whole.

We summarize the Lyon Model in the following table. The columns can be read vertically, for the standard linear sequence on the left and our modification on the right. Each element can also be compared horizontally.

Standard Linear (Expert Driven)	Lyon Model (Bottom-up)
Curiosity-driven research goals	Expression of widespread social need
(Incremental) public funding	Targeted “moonshots” – 10x / 100x
Expert-driven research	Public / expert cogeneration of research
Precompetitive transactions (\$ <-> IP)	Open source research communities
Invention disclosure	Invention disclosure
Property transactions: patent, license	Negotiated hybrids of proprietary & open
Industry development	Industry and community development
Inter-firm competition	Continuous user inputs
Modest government bridging	Government partnerships
Market demand	Social narratives about goals of use, success
Innovative product in marketplace	Continuous dialogue-based improvement

The Lyon model of innovation is conceived around relationships--relationships embedded in and congruent with the fabrics of societies. Its key driver is social benefit: an invention catches on and spreads if and only if it meets the collective needs and requirements of adopting cultures (which vary around the globe). This driver affects government interventions in both policy and funding, the investment community, product providers, and both businesses and non-governmental organizations. Most conference participants felt that patents and copyrights play an inordinate role in this process. For the most part, the public does not know the impact of intellectual property policies, nor do patent and copyright policy setting bodies seek or heed advice from society. The Lyon innovation model recognizes that there are many non-linear and variable elements of the process by which an invention achieves value through use/adoption. The crucial common element, however, is the need for *exponential increases in openness and communication* among the participants in every aspect of the innovation process. The model seeks to encourage the ubiquitous inventiveness of people in all walks of life, and collaborations that offer infrastructural support for the realization of this inventiveness. Our model does not deny the value of business and its profit motive in this regard, but it takes advantage of the entrepreneurial and creative cultures that have been successful for societies around the world.

In the context of nanoscale innovation, *X-IRG-5 States of Innovation* and the IRG in which it began have been concerned with equitable collaboration, with open disclosure of technological developments, with variable and in many cases noncommercial pathways for technology transfer, and in transparent as well as inspiring public narratives. These themes are synthesized in the Lyon conference and volume. It is a capstone project for the group and an intervention in innovation reform that we hope stirs intensive debate.

X-IRG-5b Nano Solar Project

Newfield, Boudreaux

A special topic project on solar energy will be the focus of Newfield et al. during the coming year. The aims and approach of this project include the following:

- Current crisis: none of factors that created US leadership and/or rapid global adoption in computers, agriculture, etc. are present in solar or nano-solar (e.g. R&D now 0.0075% of the US's \$1 trillion energy industry, 1000x too small)
- Current scholarship: good on policy failures (Laird 2001), weak on R&D and business structures, nothing on 3rd generation nano-enabled
- Response: book on the leading-edge nanoscale research that has true transformative potential to decarbonize energy consumption faster than is currently imagined
- Designed to put nanotechnology in the context of one of the greatest challenges humanity has ever faced, one that current evidence suggests will defeat us.
- Dramatize the struggles of the full complement of actors as they attempt to create the conditions for this research to make a difference. What factors and forces will allow us to pull this one out?
- Methods: use of existing pub, patent, firm analysis, combined with firsthand accounts, contact with the actors, players, companies, officials, etc. involved in a diverse effort.

During the past year, Hovey programmed a portion of the Newfield website that aims to pilot an open-source resource for patents and publications in selected areas related to solar energy systems development.

Co-funding

Co-funding for the Lyon conference was provided by Cluster 14, Région Rhône-Alpes, an industry consortium focused on regional development and intellectual property. Conference space was provided by the University of Lyon 3.

X-IRG: Publications

1. Chris Newfield. 2010. "Is the Corporation a Social Partner? The Case of Nanotechnology," Afterword in *Cultural Critique and the Global Corporation*, Eds. Purnima Bose and Laura E. Lyons. Indiana University Press: pp. 215-224.
2. Chris Newfield. 2010. "Review of Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: University of Chicago Press, 2008)," *Technology and Culture* 51 (October): 1058-1060.
3. Chris Newfield. 2010. "Science out of the Shadows: Public Nanotechnology and Social Welfare," Special Issue "States of Welfare," *Occasion* Volume 2: 1-19.
4. Chris Newfield. 2010. "Avoiding Network Failure: the Case of the National Nanotechnology Initiative," in Fred Block and Matt Keller, *State of Innovation: The U.S. Government's Role in Technology Development*. Boulder, CO: Paradigm Press.
5. David Mowery. 2010. "Nanotechnology and the U.S. national innovation system: Continuity and Change." In *Understanding Nanotechnology*, Eds. Fiedeler, C. Coenen, S.R. Davies, and A. Ferrari, pp. 85-100. IOS Press.
6. Suzanne Scotchmer. 2011. "Cap-and-Trade, Emissions Taxes, and Innovation," *Innovation Policy and the Economy* 11:1.
7. Johansson, Mikael. (2010). Entry. In David H. Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanoscience and Society* ("Nano Culture": 462-463). London: Sage Publications.
8. Barbara Herr Harthorn and John W. Mohr. Eds. *The Social Life of Nanotechnology*. Routledge (expected 2011/2012).
9. Mikael Johansson. "Working for next to nothing – labor in the global nanoscientific community." In *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John W. Mohr. Routledge (expected 2011/2011).
10. Mikael Johansson. "Technological utopia." In *Green Series, Volume 10, Technology*. Sage (Under review).
11. Mikael Johansson. "Vi är dina provexemplar" – om etnografiskt fältarbete i laboratoriemiljö. In *Att tänka genom kulturer*, Ed. Bärmark, Jan (Under review by Carlssons Förlag).

In Preparation

1. Chris Newfield and Daryl Boudreaux, eds. *Can Rich Countries Still Invent?* Book manuscript in preparation.
2. Chris Newfield and Daryl Boudreaux. "Introduction: The Innovation Crisis and a Post-Linear Model." In *Can Rich Countries Still Invent?* Eds. Chris Newfield and Daryl Boudreaux. In preparation.
3. Chris Newfield and Daryl Boudreaux. "Manifesto for a New Innovation System." In *Can Rich Countries Still Invent?* Eds. Chris Newfield and Daryl Boudreaux. In preparation.
4. Chris Newfield and K. He. "Solar Energy Funding After the Crisis: Has the Obama Administration Made a Difference?"
5. Chris Newfield and Jerry Macala. "Do Patents Measure Innovation? Lessons from a Quantum Dot Case Study."
6. Chris Newfield and Jerry Macala, "Can Patents Tell a Public Interest Story? Rates of Reporting Government Interests in Nanotechnology Patents."

X-IRG Presentations 2010-2011

1. Johansson. "Working for Next to Nothing: Labor in the Global Nanoscientific Community," Labor and Morality in the Global Economy, Society for Applied Anthropology, Merida, Yucatan, Mexico, March 24-27, 2010.
2. Newfield. Chair and organizer, *States of Innovation* Conference, Lyon, France, April 2010.
3. Newfield. "Introduction: An Innovation Crisis," Opening presentation in the *States of Innovation* Conference, Lyon, France, April 2010.
4. Newfield. "Could a Better Public Narrative Help Solar Energy?" *States of Innovation* Conference, Lyon, France, April 2010.
5. Barnett. "Third Generation Technology Transfer," Presentation in the *States of Innovation* Conference, Lyon, France, April 2010.
6. Boudreaux. "Innovation Needs for Nanoenabled Solar Energy Systems," Presentation in the *States of Innovation* Conference, Lyon, France, April 2010.
7. Mowery. "Innovation Systems at the Crossroads: Comparative International Conditions" Presentation in the *States of Innovation* Conference, Lyon, France, April 2010.
8. Johansson. "What is it Like to be a Postdoc?" Panel at UCSB Graduate Division, UCSB, Santa Barbara, CA, United States, April 22, 2010.
9. Newfield. "Innovation Troubles" and blogging workshop," CNS Seminar, May 11, 2011.
10. Newfield. "Can the US National Innovation System Work for Low- and Medium-Income Countries?" INRA, Ivry-sur-Seine, June 2010.
11. Johansson. "'Risky business' – How Toxicologists Negotiate the Potential Danger of Nanoparticles," Global Structures, Scientific Cultures, International Sociological Association, Gothenburg, Sweden, July 11-17, 2010.
12. Johansson. "Why Everybody Loves Nanotechnology," Technologies in Public Sphere, Society for Social Studies of Science, Tokyo, Japan, August 25-29, 2010.
13. Newfield. "Nanotechnology, Quantum Dots, and Open Source," Nanorama, Lorient, France, September 2010.
14. Newfield. "Is Nanotechnology Changing Technology Transfer?" S.NET Conference, Darmstadt, Germany, October 2010.
15. Frederick. "A Value Chain Research Approach to Nanotechnology: a Framework for Competition and Collaboration," CNS Seminar, March 2, 2011.

10. CNS-UCSB DIVERSITY PLAN

CNS-UCSB recognizes from experience that diversity strengthens the quality of research and the capacity to disseminate to a wide range of community audiences. Our diversity mission is focused on creating a diverse Center of outstanding researchers, staff, and advisors of different gender, racial, ethnic and disciplinary and family educational backgrounds that represent and reflect the communities we serve in our research mission. Additionally, the Center has broadened participation by seeking out researchers in other countries, across North America, Europe, Asia and Africa, including increasing numbers in the Global South.

(i) Current status and progress this reporting year and since 2006

Undergraduates

Undergraduate interns for our *8-week summer internship program* were recruited through a broad, campus-wide call, through email announcements and fliers to all majors.

Announcements were also sent specifically to our contacts in SACNAS and Los Ingenieros student organizations, to distribute to students. For the current reporting year, summer undergraduate interns included 3 male and 1 female students, including 1 African American and Latina female, 1 White and Pacific Islander male, and 1 Asian male. Cumulatively since 2006, interns from underrepresented groups are noted in Table 10-1. In addition, at least 5 of the twenty-four interns were first in their family to graduate college, and one intern listed a disability. Half (n=12) of our interns have been from California community colleges (a partnership with the UCSB California NanoSystems Institute's (CNSI) INSET (REU) program, and half (n=12) from UCSB. Interns also contribute to the academic diversity of CNS, with majors or minors in social science, humanities and science departments.

Table 10-1: Diversity information, **Summer Undergraduate Interns**, 2006-2010 n=24

Female	African-American*	Asian*	Latino*	Mixed racial origins*
9	2	4	3	4

*this type of data not available for all INSET community college students

Academic Disciplines of Interns: Anthropology, Biology, Business Economics, several branches of Engineering, Geography, Literature, Mathematics, Microbiology, Philosophy, Physics, and Sociology

[Current reporting year: summer 2010: We received applications from 24 students, for 2 intramural internship positions. Applicant pool statistics: 8 female, 10 Caucasian, 1 mixed race (including Pacific Islander), 1 Asian, 6 Latino/a. Applicants represented 15 different majors. Applicant information is not available from CNSI for the extramural INSET program applicants, of whom we selected 2 for internship positions, for a total of 4.]

In addition to the summer internship program, CNS engages primarily UCSB undergraduates throughout the year directly in the research process and/or in research administration. This growing pool of undergraduates is exposed to cross-disciplinary investigation and research methodologies. Although not always selected via an open recruitment, these students (n=8) contribute to the Center's diversity as indicated in Table 10-2. Fully 88% are female, and beyond that 50% are from other under-represented categories.

Table 10-2: Diversity Information, **undergraduate researcher assistants**, Current Year n=8

Female		Asian	Mixed racial origin	Native American	Latino/a Ethnicity
7		2	1	1	2

Academic Disciplines of current year UG research assistants: Biology, Chinese, History, Geography, Environmental Studies, Linguistics, Global Studies, Psychology

Graduates

The CNS Graduate Research Fellowship program recruits participants through an open, competitive application process. Diversity data for the complete cohort of 13 graduate fellows active during the current reporting year (8 Social Sciences/Humanities and 5 Science and Engineering Fellows) is as follows: 7 Female, 1 African-American, 1 Latina; 2 are first in their family to graduate college, and 4 will be first to receive a graduate degree.

Table 10-3: Diversity information, **Graduate Research Fellows**, 2006-2010 n=23

Female	African-American	Asian	Latino/a	Mixed racial origins
10	2	1	2	1

[Current reporting year: Application data for the 2010-2011 Fellows in the Social Sciences and Humanities. Twelve graduate students submitted applications for five positions. Statistics on the applicant pool: 6 male, 6 female; 9 Caucasian, 3 Latino/a, 1 Asian/Black; 1 is first in his/her family to graduate from college and 2 are first to receive a graduate degree.]

CNS engages an increasing number of graduate students beyond the fellowship program. These students serve as Graduate Student Researchers, research assistants, and in a variety of other data collection and analysis functions. As indicated in Table 10-4, of the current cohort (n=13) 62% are females, and beyond that, 46% are drawn from other under-represented categories.

10-4: Diversity information, Other **Graduate Student Researchers** , Current Year=n=13

Female	African-American	Asian	Non-US		
8	1	2	3		

Academic Disciplines of current year graduate student researchers (non-fellows):

Computer Science; East Asian Languages & Cultures; English; Environmental Science & Management; Geography/GIS; Global Studies; Linguistics; Media Arts & Technology; Political Science

NB: we are not here reporting on students at our partnering institutions.

Postdoctoral Scholars

CNS began its postdoctoral program in Fall 2008. As in our other programs, we strive for a diverse and excellent applicant pool through an open, competitive recruitment process. Positions are broadly advertised to achieve this aim; one example is sending announcements to professional society specialty groups that are geared toward diversity. The 3 CNS-funded postdocs have included one Asian, one Canadian, and one N. European participant. Of four additional postdoctoral scholars affiliated with CNS through co-funded projects, three in the

reporting year are female, with one reporting as mixed-race Latina. CNS also supports a number of postdoctoral scholars through several subawards at partnering institutions.

Leadership: Pls, Advisory Board, Senior Personnel

At all junctures in its development, the CNS has recruited staff and participants with attention to diversity of ethnicity, gender, and experience. The Center Director and PI is a woman, a professor of Feminist Studies, a past member of the governing boards of the UCSB Institute for Chicano Studies and the UCSB Center for Black Studies, a current member of the Advisory Committee for the new Center for Latina/o Health, Education & Research as well as the AAAS' Committee on Opportunities in Science (COOS) whose role is to enhance the participation nationally in Science and Engineering of women, people of color, and people with diverse disabilities, sexual orientations, and other needs. The CNS Executive Committee has a record of gender balance (3 out of 7 members have been women) and some ethnic diversity. With changes in the Committee during the last reporting year, however, we have lost some of the gender and diversity balance, and are cognizant of this issue and taking steps to address. The additions of Education Director Dilleuth and Assistant Director Gilkes, both women, as *ex officio* members adds gender diversity; the CNS will seek to augment gender and ethnic diversity at this management level.

Senior Personnel from within UCSB who are being added to the Center under the Renewal Award address diversity balance, with the addition of 3 females, one Asian-American, and one researcher of Latina ethnicity.

The CNS staff also reflects a commitment to diversity. The previous CNS Office Manager (through Aug 2009) was a 1st generation Latina of Mexican origin, our previous Financial Administrative Analyst (through June 2009) was South American, and our Education Director is a woman with an advanced degree in geography (a field predominated by men). Of current administrative staff, two are women who identify Latina ethnicity, one is Asian, and our Assistant Director is a woman with immigrant grandparents and is first generation to obtain a graduate degree.

In addition to racial, ethnic and gender diversity, disciplinary diversity is a hallmark of CNS, as noted above in our student participants. CNS participants represent a wide breadth of educational background and disciplinary experience. Including department affiliations, the CNS Executive Committee member have bring expertise and perspectives from Anthropology, Chemistry/Biochemistry and Materials, Communication, English, Feminist Studies, Global and International Studies, History, Political Science, and Sociology. Senior Personnel at UCSB expand that list to include: Chicana & Chicano Studies, Engineering, Environmental Studies, Geography, Global Economics, Microbiology, and Physics. And our collaborators at other universities and settings add Asian Studies, Business, Economics, Science Journalism, Law, Risk Studies, Social Psychology, Science Policy, and Visual Studies.

The CNS National Advisory Board was recruited with attention to diversity by gender, ethnicity, and interest in the equity issues that are likely to accompany emerging nanotechnologies. The Board is nearly 50% women, including the Board Co-Chair who is professor and associate dean for research at Evans School of Public Affairs, University of Washington ([Ann Bostrom](#)), a Chemistry professor and the executive director of the Center for Biological and Environmental Nanotechnology at Rice University ([Vicki Colvin](#)), the executive director of the California Council on Science and Technology ([Susan Hackwood](#)), and a professor in the History and Sociology of Science department at the University of Pennsylvania ([Ruth Schwartz Cowan](#)) who is a leading scholar on the gendered history of science and technology. Board member [Willie Pearson](#) is

African-American, a very active participant in NSF EHR and also contributes strongly to CNS goals of improving diversity.

Senior personnel from CNS-UCSB's collaborating institutions, many of them international, have contributed to the cultural diversity of the CNS; fewer contribute to gender/ethnic/racial diversity, although 4 collaborators count Asian heritage and 5 are female. Leveling this imbalance has been a goal in recruiting new participants for the renewal period, years 6-10 of the Center.

Visiting Researchers

The CNS Visiting Researcher program has attracted scholars that contribute to the Center's diversity. Recent visiting scholars include 4 females, 3 junior scholars, one Asian, one E. European, 2 Mexicans, and plans are underway to host a scholar who specializes in gender studies.

Connections to national organizations committed to diversity goals

This program appears to be unusually effective in attracting women and minority STEM students who are particularly interested in the kinds of social and equity issues research in the CNS portfolio. The program drew particular praise from visiting SBES AGEP program leaders in 2008 and seems likely to become a model for others. As a direct result of this presentation, Harthorn was invited to become a member of the AAAS Committee on Opportunities in Science, which she joined for a 3-year term in 2009. This national service provides CNS with direct access to many of the leading programs in the country for expanding opportunities for women, minorities, and persons with disabilities; it also provides a venue for CNS to contribute to national level discussions, initiatives and dialogue on these all important issues.

(ii) Plans for the next reporting period

Undergraduate and Graduate Participants

One primary strategy for maintaining if not improving diversity is to start with a diverse pool of strong applicants for our programs. Therefore, a current and future goal to recruit as large and diverse a pool of students as we can enables us to create a diverse community of outstanding young scholars in our programs. The following strategies reflect those we have used with success over the past 5.25 years, as well as new or anticipated strategies for enhancing diversity. Fortunately, UCSB and the central coastal California area in which it is located, are highly diverse, particularly reflecting the growing Latino population, but also have notable Native American, Asian American, and African American population bases. As a rising Research 1 campus in a beautiful coastal setting, UCSB is successful in recruiting a diverse student body and is itself projected to become a Hispanic Serving Institution (HSI). California currently has 76 HSI schools in the community college and state university system, and CNS is drawing from such neighboring organizations in recruitment for its popular undergraduate summer intern program.

Strategies:

- Open recruitment process

A competitive, open recruitment process for our undergraduate internship, graduate fellowship, and postdoctoral programs has allowed us to attract a broad range of applicants. For internal programs (graduate and UCSB undergrad internships), program opportunities have been advertised by email and fliers to all pertinent UCSB departments to disseminate to students, augmented by announcements to the UCSB Women's Center, campus organizations including

Women in Science and Engineering (WiSE), SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) and Los Ingenieros, to ensure that students from underrepresented groups find out about our opportunities. For community college interns, CNS works closely with campus partners and established networks in area community colleges to recruit a diverse, talented pool of applicants.

- Collaborating with NSF diversity programs and campus organizations
From its inception to dissolution in 2009, CNS collaborated with the AGEP (Alliance for Graduate Education in the Professoriate) program, including a very well received invited talk on the CNS Education program by CNS Director Harthorn at the NSF SBES AGEP meeting (May 2008) at UCSB. CNS has had one NSE fellow who is a veteran of the AGEP program.

The UC-DIGSS program (Diversity Internships for Graduate Study in the Social Sciences) supports UC recruitment of minority students in the social sciences, and this collaboration allowed us to successfully recruit a new incoming Latina sociology student who worked with us from 2007-2010 first as an Associate Fellow and then a CNS Social Science Graduate Research Fellow.

A relatively new NSF Bridges to the Doctorate program in CNSI aims to connect students to NSF funded opportunities. CNS participates in this network of programs that seek to recruit and retain excellent scholars from underserved populations.

In addition, CNS researchers and Education staff have developed ties with student organizations that serve underrepresented groups, including Los Ingenieros, SACNAS, and Women in Science and Engineering (WiSE). These groups address a wide variety of interests within the student community, and CNS research that focuses on environmental and social impacts has resonated with these groups' members. Presentations to these organizations by education staff, graduate research fellows and postdocs have informed participants about nanotechnology and society issues and current research, as well as described opportunities for students in CNS. CNS will seek to collaborate with new diversity programs that may begin at UCSB and is in close communication with key administrators in L&S, Graduate Division, and the Graduate School of Education.

- Partnering with California Nanosystems Institute (CNSI) Internships in Nanosystems Science, Engineering and Technology (INSET) REU program for recruiting California community college students

INSET is a unique REU program in that it is specifically designed for community college students, a high percentage of whom are from underrepresented racial and ethnic groups. Since 2006, half of all of our undergraduate summer interns (12 out of 24) have been in the INSET program. Between 2002 and 2010, the entire group of CNSI INSET interns was 45% minority, 42% female and 3% disabled (diversity data not available for individuals over this full period). Tapping into this recruitment network is useful in increasing CNS diversity. For 2011 and beyond, we are expanding our partnership with INSET to support all of our summer interns through this program.

CNS believes that diversity reproduces itself. Diversity in our CNS graduate fellows program helps to make CNS a welcoming context for undergraduates of diverse backgrounds as well. In a regional program such as ours, word of mouth and reputation are important factors in successful recruitment and retention, as is leadership dedicated to achieving a diverse organization that welcomes and supports a wide range of talents, experiences, and interests.

We believe CNS has created a climate of cross-cultural and cross-ethnic acceptance at all levels.

We are continuing to seek innovative ways to disseminate the undergraduate curriculum (INSCITES) so that we can create a network of faculty who teach at higher education institutions that serve significant numbers of underrepresented students. CNS faculty and Education staff have partnered with CNSI and Santa Barbara City College (SBCC) in a successful NSF STS award to introduce an INSCITES course to the community college (PI, CNS Education Director Dr. Julie Dilleuth). UCSB graduate students are involved in starting to build this network through teacher training and support. In addition, the same INSCITES course has been adopted in the UCSB Gevirtz Graduate School of Education's new Science and Math Initiative (SMI) undergraduate minor program, and will be offered in Spring 2011.

Postdoctoral Researchers

Our postdoctoral program remains modest due to funding constraints. All CNS postdoctoral positions are recruited in an open, competitive process. For postdoc recruitment CNS aims at a national and international audience through extensive advertising in topical nano, STS, disciplinary, and other listservs, professional organizations, bulletin boards and other avenues. In recruiting for open or new positions, we have worked with the UCSB Office of Equal Opportunity, and in addition to the traditional networks, listservs, and professional organizations (above) we have sent our advertisements to specialty groups serving women and minorities. Going forward, we will continue to broaden our reach to connect with as diverse a group of potential applicants as we can.

Leadership: PIs, Advisory Board, Senior Personnel

To enhance diversity on the faculty level, we have been mindful of our commitment to diversity, recognizing its contribution to research excellence and the broader impact a diverse group can have on the climate and culture of our Center. Senior personnel have included those of Asian and mixed Asian and White racial identities. In planning for renewal for years 6-10, diversity at the Senior Personnel level has been enhanced with the addition of 5 new female senior personnel. One of the proposed additions is a disability research expert. We also have expressly sought to include faculty earlier in their careers and are adding two assistant professors at UCSB and another at Univ of Wisconsin. Disciplinary diversity continues as we will add at UCSB: Chicana and Chicano studies, communication, economics, and environmental studies; including collaborators we add in science journalism and law.

Virtually all the current Advisory Board members have committed to continued service for the next reporting period, and going into the next five-year funding period. It is not expected that the same Board will serve all ten years, and thus in replacing those roles over time we will continue to pursue diversity goals in recruitment.

Engaging a Diverse Public

In order to ensure that all groups in the Santa Barbara area are aware of CNS activities, we will continue to plan and organize our community events, including speakers and NanoDays, in order to reach and represent the interests of the wide range of diverse groups in the population in Southern California. In research, we have recruited and will continue to recruit public deliberation participants in panels that reproduce the socio-demographic diversity of the communities in which we conduct them (Santa Barbara, Vancouver, and Cardiff, UK). Studying the effects of such diversity on public participation and group dynamics is an important component of the research.

11. EDUCATION

The CNS brings together researchers and students in the social sciences, humanities, engineering, and science to create new, critically-needed collaborative education programs. It sponsors graduate fellowships and undergraduate internships, and new undergraduate curriculum. Many of these events and activities take place in collaboration with the California NanoSystems Institute (CNSI).

The Education program is led by Dr. Julie Dillemath. As Education Director, Dr. Dillemath provides the day-to-day coordination of CNS educational and engagement activities as well as strategic planning for the education and public engagement programs.

CNS Education Program Objectives & Key Programs



Program Summary: Metrics

The following metrics reflect our primary program objectives:

Training the next generation of interdisciplinary scholars

Metric	Met in current reporting year?
7-8 graduate research fellowships/year	Yes (8 in 2009/10; 7 in 2010/11)
4 undergrad internships/year, incl. comm. college students	Yes
6 postdoctoral scholars, total years 2006-10	Yes (6 this year (3 CNS-funded))
20 seminars per year	Yes
1-2 visiting speakers per quarter (3-6 per year)	Yes
Professional development in the areas of communication, teaching practices and job search strategies	Yes (see Postdoctoral, Graduate and Undergraduate report sections for details)
At least one major public engagement event annually where Fellows and Postdocs take the lead role	Yes (NanoDays)
Funding and professional preparation for conference travel for participants	Yes (travel funds for 23 conferences to date)
Ongoing formative and summative evaluation	Yes (annual survey)

Diversity – creating a diverse community of scholars within CNS

Metric	Met in current reporting year?
Continue to cultivate diversity among student participants, maintaining current levels: 45% women, 25% underrepresented groups, 50% first generation grads	Yes (47% women, 35% underrepresented groups; only 24% first gen grads (fellows) or undergrads (interns))

Curricula Development and Dissemination:

Metric	Met in current reporting year?
Annually increase the number of new or modified courses incorporating CNS research	Yes (15 this year, 11 previous year)

Creating a community across the disciplines (SS, Hum, NSE)

Metric	Met in current reporting year?
Tracking the home departments of participants at CNS seminars	Yes
Tracking the participation of fellows that continue after their funding ends	Yes
Tracking the locations of guest speakers and guest lectures by CNS participants both on the UCSB campus and at professional meetings off campus	Yes
Tracking the background of participants who attend Nanomeeter events	n/a

Program Details**CNS Graduate Research Fellowships in Social Science and Humanities and Science and Engineering**

CNS-UCSB awards fellowships to outstanding graduate students pursuing research in the social sciences and humanities and science and engineering. Graduate research fellows take lead roles in the Center's research and education initiatives, and are trained within the interdisciplinary research groups in a unique co-educational context of joint social science and nanoscale science and engineering research and training.

CNS Graduate Fellows for 2009/2010

Fellow	Department	Affiliation
Meredith Conroy	Political Psychology	IRG-3
Summer Gray	Sociology	IRG-1
Erica Lively	Electrical & Computer Engineering	IRG-3
Tyronne Martin	Chemistry	IRG-3
Rachel Parker	Sociology	IRG-4 (now IRG2)
Claron Ridge	Chemistry	IRG-4 (now IRG2)
Christine Shearer	Sociology	IRG-3
James Walsh	Sociology	IRG-4 (now IRG2)

CNS Graduate Fellows for 2010/2011

Fellow	Department	Affiliation
Peter Burks	Chemistry	IRG-2
Amanda Denes	Communication	IRG-3
Roger Eardley-Pryor	History	IRG-1
Cassandra Engeman	Sociology	IRG-3
Shannon Hanna	Environmental Science & Management	IRG-3
Claron Ridge	Chemistry	IRG-2
James Walsh	Sociology	IRG-2

The reporting period covers two fellowship years; the 2009/2010 Graduate Fellows participated from Sept. 2009 to Sept. 2010 and are discussed in detail in the Year 5 (2009-2010) Annual Report. The 2010/2011 fellows participated from Sept. 2010 through Sept. 2011, and are discussed here.

For 2010/2011, seven graduate research fellowships were awarded. While these fellowships are generally for a 12-month term beginning Fall quarter, one fellow (Denes) began her tenure in Jan 2011. In 2010-11, four fellows are graduate students in the social sciences or humanities and three are in science and engineering (listed in table above). One social science Fellow and one science and engineering Fellow continued from the previous year (shaded in gray in the table above), one fellow (Engeman) was a CNS GSR in the previous year, two graduating fellows have continued on (as a CNS postdoc and as a researcher), and graduating fellows continue to affiliate with CNS as research collaborators from their professional appointments, all strong measures of the program's success in meeting essential career goals and professional training needs for grads. In 2010-11 nine current or former fellows received degrees (one Master's and eight PhD's). The Graduate Fellows program is a major component of CNS-UCSB's mission to produce and encourage excellent and innovative scholarship that addresses the intersection of nanotechnologies with society and to contribute to academic workforce development for future nanotechnology research. Fellows, in residence at UCSB, work directly with a faculty mentor in one of the IRGs, and IRG leaders typically have one social science and one science/engineering Graduate Fellow each. For 2010-2011, Fellows came from five different departments and disciplines.

Summary demographic information (out of 7 total):

2 Female

1 Will be first in family to receive graduate degree

The fellowship term began with an orientation workshop for new fellows. Fellows continued to meet bi-weekly, year-round in a graduate seminar (Soc. 591 BH) with faculty researchers, visiting scholars, and other interested members of the campus community.

Evaluation

As part of ongoing formative and summative evaluation we collect feedback from fellows regarding their expectations and their general level of satisfaction and perceived benefits regarding their CNS research experience and progress. Responses identify particular strengths as well as areas for improvement in the Fellowship Program, and the feedback is used in planning programming that meets the needs of the participants. Education Director Dillemath conducted the annual survey on the Graduate Fellows program in Fall 2010 (concerning total CNS experience), as CNS transitions between cohorts. This year, CNS instituted a new survey

for former fellows who have been out of graduate school for more than one year. This annual survey is shorter and focuses on the impact of the CNS experience in a person's professional life during the past year, and tracks any current interdisciplinary activities. Of the 22 fellows with at least one year at CNS, current and alumni/ae, 15 responded to the 2010 surveys.

The Fellow experience continues to be rated positively, with cited benefits that include interest in and ability to engage in interdisciplinary research, and resources for research that would not have been available otherwise. The most salient challenge was that some Science and Engineering Fellows reported feeling a lack of communication and understanding from Social Science Fellows. To encourage better communication and cohesion in the 2010-2011 Fellows cohort, the Fall Orientation was restructured to be much more interactive and Fellow-driven, and included presentations and discussion led by the Science Fellows.

From the new survey for those who have graduated from UCSB a year or more ago, 3 out of the 4 respondents cited the following activities during the past year that were positively impacted by their CNS experience: professional development, research area and experience, and interdisciplinary interactions. Comments indicated that CNS participation played a role in shaping current research and career trajectories and contributed to making former Fellows marketable during their job searches.

CNS-UCSB Postdoctoral Scholars Program

In 2008 CNS-UCSB initiated an on-site Postdoctoral Scholar program, and over the past three years this has grown to a group of six scholars, listed in the table below. Three of these scholars are funded through other NSF awards but maintain a significant presence in CNS and are considered part of CNS. Three postdocs are currently in their second year with CNS. One (Johansson) completed a two-year research term at CNS and has returned to a faculty/research position at the Univ of Gothenburg in Sweden. Another (Rogers) has moved to a faculty position at Long Island University. In addition to its on-site postdoctoral program, CNS-UCSB is funding a full-time postdoctoral researcher at Duke University to work on a cross-working group spatial analysis project examining the impact of California nanotechnology in the global economy, and CNS has partially supported three postdoctoral researchers at partnering institutions Cardiff (Tee Rogers-Hayden, Adam Corner) and Univ of British Columbia (Aaron Pitts). CNS is committed to providing quality mentorship in research and professional skills towards postdocs' career and personal goals as an integral part of our plans to involve postdoctoral level scholars in our research, education, and outreach programs.

CNS Postdoctoral Scholars, 2010, 2011

Postdoc	PhD	Affiliation
Gwen D'Arcangelis*	Women's Studies, UCLA	IRG 3
Matthew Eisler	History, University of Alberta	IRG 1
Mikael Johansson	Social Anthropology, Univ. of Gothenburg	IRG 1 & 3
Yasuyuki Motoyama	City & Regional Planning, UC Berkeley	IRG 4 (now IRG 2)
Jennifer Rogers*	Sociology, Women's Studies, UCSB	IRG 3
Christine Shearer*	Sociology	IRG 3

* indicates postdocs funded through other awards, but housed and collaborating in CNS

CNS provides a variety of mentoring and professional development opportunities for postdoctoral scholars at UCSB. On the academic side, our postdoctoral scholars give formal research presentations in the CNS Seminar, are encouraged to submit to and present at

conferences, and prepare and present research posters for the annual CNS Research Summit and National Advisory Board meeting. At these meetings, they have the opportunity to engage with CNS external collaborators and elite board members, which develops and expands their networks. CNS provides postdocs with funding for research presentations at conferences as well as opportunities to represent the CNS at national and international workshops, meetings and conferences (21 this year). The CNS Graduate Seminar (discussed below), attended by CNS faculty, postdocs and graduate fellows, includes academic and professional development discussions on various topics such as interdisciplinary collaboration; social science, humanities and science/engineering methodologies; publishing; training on oral and poster presentation design and communication; and other topics identified through regular evaluation surveys. The postdoctoral scholars have collaboratively planned seminar meetings, and starting with our new seminar format in Fall 2010, have taken lead roles in planning seminars and hosting visiting scholars around a specific theme.

Postdoc participation has been instrumental in the following activities and programs over the last year: NanoDays, CNS's largest public engagement event around nanoscale science informal education; presentation to the summer undergraduate interns; mentoring CNS graduate fellows, and presenting at UCSB Graduate Division's panel for new graduate students.

On a day-to-day level, postdoctoral scholars meet regularly with their mentors. The structure of the IRGs promotes close collaboration and mentorship with PIs, including interdisciplinary collaboration, at both the postdoc and graduate fellow level. Postdocs are also kept well-informed about events and activities in related departments and programs on UCSB campus. The Education Director forwards relevant lecture and visitor announcements from NSE departments, the Bren School of Environmental Science and Management, the UCSB Center for Information Technology and Society (CITS), as well as social science and humanities departments. New CNS postdocs participate in a training workshop on CNS policies and procedures, to help them utilize resources more effectively and to facilitate their taking leadership roles in the Center.

Apart from academic mentoring, CNS-UCSB supports postdoctoral scholars in personal development toward their career objectives. Our Center Administrator conducts an administrative orientation for new postdocs, socializing them into the world of grant management. Postdocs and their mentors are provided and strongly encouraged to use the Individual Development Plan for Postdoctoral Fellows (IDP) developed by the Federation of American Societies for Experimental Biology (FASEB), a document utilized in many universities as an effective framework for identifying and meeting professional development needs and career objectives. Campus programs provide broader support: CNS postdocs have taken part in the new Professional Development Program for Postdoctoral Scholars, sponsored by the California Nanosystems Institute (CNSI), attending workshops on grant writing, ethics in research, and statistical tools. In addition, CNS postdocs are part of the UCSB Society of Postdoctoral Scholars, which provides training, development, and social opportunities for campus postdocs. For support materials, articles, and guides on mentoring and career development, the UCSB Graduate Division provides an extensive online collection (<http://www.graddiv.ucsb.edu/postdoctoralscholars/careers.htm>, <http://www.graddiv.ucsb.edu/postdoctoralscholars/mentoring.htm>).

Evaluation

We evaluate the postdoctoral program on an annual basis with a Fall survey to our postdoctoral participants, assessing their experience and rating of program components. Four of six current and former postdoctoral scholars responded to this year's survey, commenting primarily on the

struggles and rewards of participating in interdisciplinary research. Overall, they were very positive about how CNS has impacted their research direction and career plans. The quality of interactions with other postdocs and with their faculty mentor were rated the highest. Quality of interaction with visiting researchers and guest speakers was rated lowest. We hope that the new seminar format may result in improved ratings here, since the postdocs are now more actively engaged with inviting scholars and hosting them during their visit.

CNS-UCSB Undergraduate Summer Internship Program

CNS offers internships to UCSB undergraduate social science and humanities majors who are interested in gaining social science research experience. CNS also collaborates with the NSF funded Interns in Science, Engineering and Technology (INSET) REU program at the California Nanosystems Institute to recruit community college students to an 8-week summer research experience on the UCSB campus.

The four 2010 Interns gained first-hand experience investigating the societal issues relating to nanotechnology, in projects designed by the Graduate Fellow mentors. This was a departure from the previous two years' Traveling Nanotechnologies project, because the Graduate Fellow mentors had specific research projects in which they wanted to involve their interns. Our article on the Traveling Nanotechnologies project has been accepted to the Journal of Nano Education and we have prepared support materials to make available to others to adopt and adapt the project with their own interns.

The internship provided undergraduates training in societal implications research as well as ongoing mentoring, IRG participation and interaction, and professional development. In addition to research, the interns attended weekly CNS seminars, participated in group meetings, and developed communication and presentation skills. The culmination was an oral research presentation for CNS and research poster colloquium with all science and engineering summer interns. Following the summer program, two interns presented at conferences, a third will present at a conference in April, one research poster was presented at an international conference by the graduate mentor, and two interns continued research with their groups into the academic year.

Summer 2010 CNS Summer Interns

Intern	Home University/ Major	Grad Mentor	PI	IRG
Brent Boone	UCSB / Business Economics	Meredith Conroy	Bruce Bimber	3
Simone Jackson	Allan Hancock College, San Jose State/Mechanical Engineering and Mathematics	Christine Shearer	Barbara Harthorn	3
Srijay Rajan	Moorpark College/ Chemistry, Chemical Engineering	James Walsh	Richard Appelbaum	2
Nicholas Santos	UCSB/ Geography	Summer Gray	Patrick McCray	1

Evaluation

Evaluations completed by both interns and mentors point to a successful summer. Interns were very satisfied with the research they conducted, how much they learned, and interactions with

their mentors. They reported increased confidence in their knowledge, research skills, and communication and presentation skills as a result of participating in the program. Particular challenges reported included doing research that was outside of their science-background experience, getting used to being self-motivated, having confidence to give oral presentations, and dealing with time constraints. But the most enjoyable aspects cited were getting to know the mentors, PIs, and fellow interns, conducting meaningful research, and learning about a variety of different research areas.

Mentors evaluated their experience positively, consistent with previous years. Mentors particularly enjoyed seeing their intern's knowledge and confidence grow, being in a manager's role, their intern's enthusiasm for the project, and meeting the project goals by the end of eight weeks. Mentors had surprisingly few challenges to report, apart from typical research challenges related to data collection and analysis.

Curriculum

In September 2010, CNS held a one-day orientation workshop for new and returning Graduate Fellows, which was built around an interactive discussion of CNS mission, activities and policies and procedures, as well as specific background on the IRG research programs and nanoscale science and engineering. A working lunch with all CNS was an effective way to regroup for a new academic year and introduce new Fellows to the group. A version of this orientation was held in January 2011 for the new graduate fellow (Denes) and for new GSRs assigned to the working groups.

The CNS Seminar Soc 591 is our focal point for graduate curriculum. The biweekly seminar meetings develop an interdisciplinary community of scholars with special expertise and, for participants, help develop their ability to communicate effectively across significant disciplinary boundaries. Seminars address a wide range of issues of emerging nanotechnologies and society including social science and NSE research methods, science and technology studies, professional development topics, and substantive research within the IRGs.

In 2010-11 the seminars each quarter were organized around a theme. Themes were selected by the Executive Committee with an IRG taking the lead each quarter. IRGs invited outside speakers and employed mixed formats, such as methods-based discussions, discussion of ongoing research analysis, expert speakers, and readings-based discussions. The goal was to further IRG research, engage in cross-disciplinary dialog and topic exploration, while providing opportunity for rest of CNS a more in-depth understanding of various research projects, identify overlapping interests, and engender discussion of potential cross-IRG research projects.

Themes this year were:

Fall 2010 – Environmental Health & Safety – IRG3

Winter 2011 – Competition and Competitiveness – IRG2.

Spring 2012 -- Nano as R&D/industrial policy in the energy domain – IRG1.

This new format afforded CNS postdoctoral scholars a greater opportunity to plan and organize content, invite speakers, and lead discussion. The benefits for them included furthering their own research, professional development, and network building. The format also benefited graduate researchers by introducing and involving them to a greater extent in other research projects. Many of the sessions with outside speakers were opened to the campus community, generating interest in CNS research among departments such as Economics, Global & International Studies, and Environmental Sciences.

Seminar guests this reporting year that were also part of the CNS Speaker Series included:

- Sarah Davies, Arizona State University, "How we talk when we talk about nano: Public discussion of future technologies"
- Kalpana Sastry, Head of Division, Agricultural Research Systems Management Policies, National Academy of Agricultural Research Management (Indian Council of Agricultural Research), "Ramifications of Nanotechnology into Agrifood Systems"
- Guillermo Foladori, "Nanotechnology Social Methodological Issues" and Edgar Zayago Lau, "The Path of Nanotechnologies in Mexico", Universidad Autónoma de Zacatecas, Mexico; Latin American Nanotechnology & Society Network (ReLANS)
- Sheila Davis, Exec Dir, Silicon Valley Toxics Coalition, "Regulating Emerging Technologies to Protect Workers, Communities and the Environment"
- Fred Block, Research Prof, UC Davis, "Beyond Rationalization: Conceptualizing the Complexity of Innovation Systems"
- Jackie Isaacs, Professor and Associate Dir, Center for High-rate Nanomanufacturing, Northeastern Univ, "An Overview of Environmental Health and Safety Research at the Center for High-rate Nanomanufacturing"

Seminar guests from our own campus included Mark Rodwell, Elec & Computer Engineering Professor and Director of the UCSB NNIN Nanofabrication lab, presenting "*Galileo, Elephants, & Fast Nano-Devices*"; Dr. Dave Vandenberg, Laboratory Safety and IIPP Program Manager at UCSB Environmental Health & Safety as part of a panel on EH&S in academia and industry; and Aashish Mehta, Global & International Studies Asst. Professor, speaking on "International Collaboration and Paper Impact in Nanotechnology." And in addition to CNS faculty speaking in the seminar, CNS postdoctoral scholars D'Arcangelis, Frederick, Motoyama, and Eisler gave presentations, as well as Graduate Fellows Eardley-Pryor and Engeman.

Students in CNS have the opportunity to participate in an interdisciplinary doctoral emphasis program in Technology and Society, organized through the UCSB Center for Information Technology and Society (CITS). CNS faculty Bimber, Harthorn, and McCray are affiliated with CITS, and a close working relationship exists between the two Centers. The doctoral emphasis, which is of interest to some of our Fellows, requires coursework in the areas of culture and history and society and behavior, and a dissertation on a topic concerning technology and society. All CNS faculty and students are kept informed about upcoming events and speakers in the CITS seminar series.

New collaboration with community colleges around curriculum began in earnest with the new NSF STS award, *Bringing Nanotechnology and Society Courses to California Community Colleges*. This project, with Education Director Dilleuth as PI and McCray is co-PI, has redeveloped the "Green Works" INSCITES (Insights on Science and Technology in Society) course on technology and sustainability from UCSB with new nanotechnology content and a syllabus to fit the longer, 16-week semester of Santa Barbara City College (SBCC). An SBCC Chemistry instructor, the SBCC Dean of Educational Programs, and a new UCSB faculty member in History and Environmental Studies are co-PIs on the award, and two Graduate Teaching Scholars, from humanities and NSE disciplines, are closely involved in the redesign and teaching of SBCC Physical Science 107, *Nanoscience in Society*.

CNS-UCSB faculty, external collaborators and former Graduate Fellows incorporated Center research into 15 university courses during this reporting period, listed below. Asterisks indicate new courses.

Graduate level courses:

- FemSt 260, UCSB, *Feminist Research Methods* (Harthorn guest lecture)
- Global 230 UCSB, *Global Political Economy* (Appelbaum)
- Institute for Resources, Environment and Sustainability Student-Led Seminar Series, University of British Columbia (Beaudrie guest lecture)
- RMES 500s, University of British Columbia, *Qualitative Methods in Interdisciplinary Contexts*, (Beaudrie guest lecture)
- *Soc 496, U Wisc Madison, *Globalization and Social Change*, (Conti)
- *Soc 591 (BH), UCSB, *CNS Research Seminar*, taught four quarters/yr (Harthorn)

Undergraduate level courses:

- *Cultural Studies Program 65, Occidental College, *Science Fiction, Biotechnology, and the Future of the Human Species*. (Conroy)
- EnvStud/Anthro 130, UCSB, *Coupled Human and Natural Systems*, (Harthorn guest lecture)
- FemSt 132, UCSB, *Gender, Science and New Technologies* (Harthorn)
- Global 2, Introduction to Global Studies Politics and Economics (Appelbaum)
- Hist 7, UCSB, *History of Public Policy* (McCray guest lecture)
- Hist/Elec 234, Rice University, *Technological Disasters*, co-taught by Cyrus Mody (History, IRG 1) and Kevin Kelly (Electrical and Computer Engineering) interdisciplinary intro-level engineering and humanities course
- *Phys Sci 107, Santa Barbara City College, *Nanoscience in Society*, (Bullock; NSF STS Award)
- *Pols 203, Occidental College, *American Political Behavior and Psychology* (Conroy)
- Soc 125, U Wisc Madison, *Contemporary American Society* (Conti)

Reports to the National Advisory Board

CNS faculty and staff report on the evidence of progress towards completion of the objectives listed above at the meetings of the National Advisory Board. Specific questions raised by the evaluation data are discussed with a view to identifying problems and devising appropriate modifications. CNS convened a NAB meeting in early April 2011 to review CNS research and outreach activities.

Evaluation Databases

CNS maintains a database of all participants in fellowship, internship and public outreach events so that we can provide evidence of the nature of the population who take an active part as well as those who express interest in learning more about this field. We will use the information gleaned from participants at conferences, public events and seminars to guide our future plans for both research and education.

The CNS website serves to inform the public about highlights in the field and to advertise future events that the center is hosting (see Outreach and Knowledge Transfer section for more information on the website).

Table 3a: Education Program Participants - All, irrespective of citizenship													
Student Type	Total	Gender		Race Data								Ethnicity: Hispanic	Disabled
		Male	Female	AI/AN	NH/PI	B/AA	W	A	More than one race reported, AI/AN, B/AA, NH/PI	More than one race reported, W/A	Not Provided		
Enrolled in Full Degree Programs													
Subtotal	17	9	8	0	0	2	11	1	2	0	1	3	0
Undergraduate	4	3	1	0	0	1	1	1	1	0	0	1	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	13	6	7	0	0	1	10	0	1	0	1	2	0
Enrolled in NSEC Degree Minors													
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0	0
Enrolled in NSEC Certificate Programs													
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0	0
Practitioners taking courses	0	0	0	0	0	0	0	0	0	0	0	0	0
K-12 (Precollege) Education													
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Teachers	0	0	0	0	0	0	0	0	0	0	0	0	0
Students	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	17	9	8	0	0	2	11	1	2	0	1	3	0

Table 3b: Education Program Participants - US Citizens and Permanent Residents													
Student Type	Total	Gender		Race Data								Ethnicity: Hispanic	Disabled
		Male	Female	AI/AN	NH/PI	B/AA	W	A	More than one race reported, AI/AN, B/AA, NH/PI	More than one race reported, W/A	Not Provided		
Enrolled in Full Degree Programs													
Subtotal	17	9	8	0	0	2	11	1	2	0	1	3	0
Undergraduate	4	3	1	0	0	1	1	1	1	0	0	1	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	13	6	7	0	0	1	10	0	1	0	1	2	0
Enrolled in NSEC Degree Minors													
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0	0
Enrolled in NSEC Certificate Programs													
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0	0
Masters	0	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0	0
Practitioners taking courses	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	17	9	8	0	0	2	11	1	2	0	1	3	0

12. OUTREACH & KNOWLEDGE TRANSFER

Addressing the challenges of devising and implementing new methods for engaging and learning about the full range of stakeholders in the nano enterprise is a critical aspect of the NSEC and NNI mandates for responsible technology development and vital to the economic success of the nano enterprise as well. The core of CNS-UCSB societal implications research is about understanding and doing comparative analysis of the views of the multiple stakeholders in the nano enterprise, in order to bring them into mutual analysis, discussion, and, we hope, decision making. To that end, the CNS-UCSB pursues a multi-layered outreach and knowledge transfer program designed to reach and interact with the multiple stakeholders in the growing nano-enterprise. “Knowledge transfer” tends to imply a one-way and top-down process of knowledge deposition that is at odds with our views about the importance of two-way interaction between science and society. CNS strives to pursue the more difficult two-way forms of engagement with science and society, including all interested social actors, as well as those who lack of familiarity with nanotechnologies. Ongoing low levels of public awareness of nanotechnologies (see Satterfield et al., 2009) particularly challenge the project of *public* engagement, and CNS is discussing new approaches as we move forward.

CNS uses a range of approaches for multi-stakeholder participation. First, we query who are and should be the multiple parties who have a stake in the nano-enterprise and its responsible development. In the upstream context, this is arguably the NSE, nanotoxicologists, regulators, industry, and insurers, in addition to the public and public interest groups, and the media. The challenges of outreach and engagement across this broad base of stakeholders are many: the experts are diverse, industry is global, and there are many publics too—workers, community members in places where industry will be sited, consumers, and the potentially environmentally exposed, at local, state, national, and global levels.

The full range of CNS research is important to outreach and knowledge transfer goals, because the nano-enterprise is a complex social and historical reality, and capturing it adequately requires multiple methods and a selective, strategic approach. There is no universal approach; rather outreach much be tailored to each party, based on careful assessment and knowledge. This critical aspect of CNS work demands multiple methods through which we gain understanding of a broad range of stakeholders. These methods include: qualitative social science—interviews, small group dialogue, on-line forums, participant-observation—for learning about deeper, contextual, cultural domains, values, narratives, identities, experiences; quantitative social science—phone, web, & mail surveys, experimental research—for gaining broader representative samples, or experimental exploration with a large sample; and historical analyses – comparative, descriptive, narrative explorations of nano-enterprise via life histories of leading NSE scientists; content analysis of policy, media and other documents; archival research. Because of the highly distributed and complex global nano enterprise, the work requires collaborative, interdisciplinary, international approaches, using different toolkits and expertise, consultation with environmental and health experts and the involvement of NSE students, and a focus on traditional and new media as a vital means to understanding knowledge transmission in society.

Public engagement. The importance of citizen involvement in technological decision making has been laid out in landmark NRC publications by Stern & Fineberg (1996) and Dietz & Stern (2008). These make an indisputable case for the necessity of a new kind of ‘analytic deliberative’ process, and (2008) have shown how effective such processes can be when conducted with genuine desire for public involvement and transparent processes. So, engaging publics has been central to CNS-UCSB’s work. Following an approach widespread in Europe,

where incorporating public debate is institutionalized in policymaking, CNS-UCSB conducted a series of public deliberation forums in the US and UK in 2007 and again in the US in 2009. These deliberation workshops provide researchers with richer, deeper, contextualized knowledge about emerging public views about nanotechnologies in the context of specific applications of nanotechnologies for energy and environment and for health and enhancement. The cross-national comparisons allow unique understanding of US views in comparative global context.

Expert engagement. Since CNS started in 2006, all research groups have actively engaged members of the science and engineering community. We've done this via several approaches. One path we've pursued is the use of direct engagement – attending their meetings, studying their research and research practices, conducting interviews, and providing direct involvement of their students in our work through our novel science fellowships. CNS in collaboration with Chemical Heritage Foundation has tried to capture people's ephemeral recollections of key meetings, events, discoveries and people, and has archived these Oral Histories and made them available for others to use. We've interviewed experts in fields of nanoelectronics, nano solar, nanobio, nanomedicine, nanoecotoxicology and many others, in the US and abroad. We've collaborated in numerous joint funding proposals, a majority of them successful. And in publishing our results, we have chosen venues that reach beyond our traditional audiences of social scientists, historians and science and technology studies and reached out to disseminate our work to such publications as *Physics Today*, *Chemical Heritage White papers*, *Environmental Science & Technology*, *Nature*, *Nature Nanotechnology*, and *Nature Climate Change*, and *Chemical Engineering*. We have been invited to attend and make presentations to meetings and conferences for the semiconductor industry, the NNI and its industry participants, leading economic industry groups, as well as meetings of chemists, physicists, materials scientists, toxicologists, and environmental and occupational health and safety experts. CNS has a strong track record as well of engagement with regulators and policymakers.

In addition to initiating and facilitating more traditional science café type outreach activities and dialogue opportunities between the general public and nanoscale researchers, CNS-UCSB is increasingly seen as a research hub and dissemination portal for the nano in society research community. CNS has engaged in numerous activities (enumerated below) to reach these various and sometimes overlapping groups. Where possible, the Center partners with other organizations (e.g., Santa Barbara Museum of Natural History) to build community and extend the impacts of our efforts.

Public Engagement: NanoDays

For the past three years CNS has hosted “NanoDays” events, the annual national education effort of the Nanoscale Informal Science Education (NISE) Network. Hands-on activities are utilized, designed to engage and promote understanding of the nanoscale and nanotechnology. These are led by CNS Graduate Fellows, Postdoctoral Scholars, and additional student volunteers. After hosting events for several years on our own at both campus and community venues, CNS partnered in 2009 with CNSI. In 2010 we took NanoDays to a new level, expanding our partnerships and audience. Together with UCSB's National Nanotechnology Infrastructure Network (NNIN), UC CEIN, CNSI, and the Santa Barbara Museum of Natural History, we held a NanoDay event at the museum on Saturday, March 26, 2010, engaging nearly 500 visitors. The 2011 event features the same partnerships, and is scheduled for April 8, 2011. These events are popular with school children and families who attend and with our science and social science students and postdocs, and we anticipate continuing to participate in them.

Public Engagement: Science Café, Earth Day, & other informal science & society education

To meet its objective of creating events that engage members of the general public in discussion and debate about the societal implications of nanotechnologies and issues concerning their responsible development, CNS has partnered with CNSI and the MRL to offer a variety of informal community discussions of societal implications of nanoscale science and technology developments with both science and engineering and social science experts. NanoMeeter events serve to connect researchers with the public, and are held on weekday evenings for roughly 60-90 minutes in the local community at a publicly accessible site. Audience size has ranged from approximately 25 to 50. In March 2010, CNS IRG 3 sociologist Engeman presented in a local Earth Day panel at the public library in collaboration with the UC CEIN, IRG 2 chemist Ridge presented in an area high school, and Education Director Dilleuth presented in a NNIN Day in Science.

Campus and Community Engagement: Speakers series/Visiting scholars or practitioners

Speakers series: The CNS hosts at least 4 visiting speakers per year who present in the Graduate Seminar and to wider campus and public audiences on a range of topics. In 2010-11 we organized our seminar series around the following quarterly themes, and speakers were invited to contribute to those themes:

Fall 2010 – Environmental Health & Safety

Winter 2011 – Competition and Competitiveness.

Spring 2012 -- Nano as R&D/industrial policy in the energy domain

Seminar guests this reporting year that were also part of the CNS Speaker Series included:

- Sarah Davies, Arizona State University, "How we talk when we talk about nano: Public discussion of future technologies"
- Kalpana Sastry, Head of Division, Agricultural Research Systems Management Policies, National Academy of Agricultural Research Management (Indian Council of Agricultural Research), "Ramifications of Nanotechnology into Agrifood Systems"
- Mark Rodwell, Elec & Computer Engineering Professor and Director of the UCSB NNIN Nanofabrication lab, presenting "*Galileo, Elephants, & Fast Nano-Devices*"
- Guillermo Foladori, "Nanotechnology Social Methodological Issues" and Edgar Zayago Lau, "The Path of Nanotechnologies in Mexico", Universidad Autónoma de Zacatecas, Mexico; Latin American Nanotechnology & Society Network (ReLANS)
- Dr. Dave Vandenberg, Laboratory Safety and IIPP Program Manager at UCSB Environmental Health & Safety as part of a panel on EH&S in academia and industry, Nov 2010
- Sheila Davis, Exec Director, Silicon Valley Toxics Coalition, "Regulating Emerging Technologies to Protect Workers, Communities and the Environment"
- Fred Block, Research Prof, UC Davis, "Beyond Rationalization: Conceptualizing the Complexity of Innovation Systems"
- Jackie Isaacs, Professor and Associate Dir, Center for High-rate Nanomanufacturing, Northeastern Univ, "An Overview of Environmental Health and Safety Research at the Center for High-rate Nanomanufacturing"
- Aashish Mehta, UCSB Global & International Studies Asst. Professor, speaking on "International Collaboration and Paper Impact in Nanotechnology."

In addition, CNS co-sponsored the UCSB History Department's Badash Memorial lecture by Alice Domurat Dreger: Struggles of Science and Identity Politics in the Internet Age in Winter

2011; and a CNSI Education Colloquium in Feb, 2011 by [Diandra Leslie-Pelecky](#), professor of physics, Science Education specialist, and author of *The Physics of NASCAR: How to Make Steel + Gas + Rubber = Speed*.

These lectures were advertised to the wider campus community, across humanities, social science and engineering disciplines. The Center is making significant headway in gaining a supportive and interested constituency among Science and Engineering colleagues.

Visiting scholars and practitioners: CNS hosts an active visiting scholars program, providing extensive opportunities for CNS researchers and students to interact with scholars studying a range of issues on the societal dimensions of nanotechnologies. During the reporting period CNS hosted Dr. Kalpana Sastry, Head of Division of Agricultural Research Systems Management Policies at National Academy of Agricultural Research Management, Hyderabad, India (April 2010); Esther Ruiz-Ben (Spring 2010); Andy Perkins, Head of Science & Innovation at British Consulate-General in Los Angeles (August 2010); Jackie Isaacs, Professor in the Department of Mechanical and Industrial Engineering at Northeastern University (Feb 2011); and Stacey Frederick and Patrick Herron, both of Duke University (March 2011).

Major Events: Conferences

In alternate years CNS hosts a large, international conference. In Nov 2011 CNS-UCSB will serve as co-host of the 3rd international meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET), an organization CNS helped co-found. See conference information at: <http://www.cns.ucsb.edu/SNet2011>

In November 2009, following 2 years of preparatory work, CNS hosted a major international conference entitled *Emerging Technologies/Emerging Economies: (Nano)technologies for Equitable Development*, held in Washington DC, to examine nanotechnology applications for solving intractable human problems (for clean water, safe energy, sustainable food, and health) and their implementation in the developing world. . The event brought approximately 85 participants to the intensive 3-day workshop, hosted media and policymaker engagement events at the National Press Club and on Capitol Hill, and was deemed a resounding success by all participants. Follow up activities include the production of a volume to be published by Routledge that will further disseminate the conference's ideas on the opportunities and challenges to equitable global development of nanotechnologies. Key among the conclusions was the importance of development of open source technologies for humanitarian purposes in the developing world. More information is available at: <http://www.cns.ucsb.edu/events/nanoequity2009>.

Major Events: Specialist Meetings

In alternating years CNS sponsors workshops or specialists meeting. In Jan 2010 IRG 3 organized and convened a Nanotechnology Risk Perception Specialist Meeting. The meeting was held for two days Jan 29-30, 2010 in Santa Barbara. The meeting convened over a dozen leading international scholars from the US, Canada, the UK, Germany, Austria, Switzerland, the Netherlands, and Portugal who prepared white papers for the sessions; IRG 3 collaborators [Kandlikar](#), [Haldane](#) and [Conti](#) served as discussants; leading scholar Paul Slovic gave a concluding overview about the implications of the research presented for risk perception theory and knowledge, and for risk communication. The meeting agenda is available at: <http://www.cns.ucsb.edu/events/nanotechnology-risk-perception>, and a significant outcome is a forthcoming special edition of the leading journal, *Risk Analysis*. [Chris Newfield](#) took the lead in planning a workshop on the Nanotechnology Innovation System, to be held in Lyon, France April 29-30, 2010. Co-led by [Newfield](#), [Mowery](#), [Barnett](#) and [Boudreaux](#), this workshop

convened an interdisciplinary group of leading international specialists to discuss the effects of state investment policies and programs, IP and Tech Transfer issues, and impediments to rapid development of critical renewable energy applications as planned and hoped for. An expected outcome of the workshop is an edited volume by Newfield and Boudreaux: *Can Rich Countries Still Invent?* The meeting program is available at: <http://innovate.ucsb.edu/lyon-innovation-reader>.

Engaging Globally

CNS has had from the start strong international/global partnerships, collaborations and focus. All CNS conferences and most workshops have had strong international participation and components: NanoEquity Conference in Nov 2009; Risk Perception Workshop in Jan 2010; States of Innovation Workshop located in and partially supported by the regional government of Lyon, France; and S.NET 2010 conference in Darmstadt, Germany. In addition to its role in developing these meetings, CNS has supported expanded participation from the Global South in Science and Society conferences via travel support and conference coordination. Our researchers have been building relationships with international scholars that span more than conference participation: international researchers are contributing to CNS publications, coming to UCSB as short-term visiting researchers (Kalpana Sastry, April 2010; Edgar Zayago Lau, anticipated 2012), and expanding research networks. Appelbaum is co-PI on a UC Mexus grant to develop collaborations with Mexican scholars (and by extension, with Latin America, via ReLANS, the Latin American Nanotechnology & Society Network). Chris Newfield is editing a volume with Innovation workshop participants, who were drawn from 6 countries. Further, by virtue of international subawards, CNS is accessing and sharing data, policy analysis, and research efforts in other countries. Those subawards support students and other researchers as well, further expanding the international reach of CNS. An increased international presence is evinced by fact that over a third of CNS presentations during the reporting period were international.

Public Presentations

CNS researchers and graduate students also make numerous public presentations to campus, local, regional, and wider audiences about the work of the CNS-UCSB. In the reporting year these presentations totaled 116 and included 66 presentations in education and outreach and 50 in social science and humanities research contexts. See full listing at the end of this section (12). Additionally, CNS researchers take a leadership role in numerous scholarly organizations by organizing and chairing panels and sessions at scholarly conferences such as 4S, SRA, SRA-E, AAA, and the S.NET.

Outreach to Policymakers

As the research agenda from the CNS has begun to develop a consolidated set of research results on the *global innovation system* for nanotechnologies (IRGs 1 and 2) and issues regarding the *responsible development* of nanotechnologies (IRG 2 and 3), CNS is increasingly being called upon and initiating opportunities to disseminate findings to key national (NNI, NNCO, NIOSH, EPA, NSF, US Congressional organizations, UK governmental organizations) and state level organizations (CCST, DTSC). Former fellow, Dr. Rachel Parker, has joined the Science and Technology Policy Institute (STPI) in Washington, DC.

STS Engagement and Participation

Harthorn regularly participated 2006-2008 in the Nanotechnology in Society Network (NSN) with CNS-ASU director Guston and the 2 other funded projects at Harvard/UCLA and Univ of S. Carolina. Through Harthorn, CNS-UCSB has been directly and instrumentally involved in the creation and development of the new international professional society, S.NET, the Society for

the Study of NanoScience and Emerging Technologies, which held its inaugural meeting in Sept 2009 in Seattle. Harthorn is a founding executive committee member of S.NET, and she served on the program committee for the first two of the Society's meetings. CNS-UCSB took the lead on fundraising in the US for the 2010 meeting in Sept/Oct 2010 in Darmstadt, Germany, and CNS-UCSB and CNS-ASU will co-host the 3rd meeting of the organization in Nov 2011, for which Harthorn is co-chairing the program committee. Harthorn was a co-chair of the annual NSE PI meeting in Dec 2009, and, with CNS-ASU's director Guston, has played a prominent role in representing societal dimension issues in numerous meetings, conferences and sessions with the NSE community regarding values and mechanisms for fulfilling the aims of "responsible development" of nanotechnologies.

Expert Engagement: Nanoscientists and Engineers

Engagement with nanoscientists and engineers is a central and distinctive aim of the CNS-UCSB. The reasons for engagement are multiple. CNS aims: to understand the nano enterprise from its participants' points of view; to foster new opportunities for dialogue and engagement between nano scientists and social scientists for mutual benefit; to develop innovative methods to train a new generation of society-minded scientists and science-minded social scientists; to use the research findings of the CNS to enhance two-way communication between nano-science and society, and 3-way communication between nano-science, social science, and society. We have pursued this mission in a number of ways:

- **Executive Committee:** UCSB MRSEC Director Craig Hawker, an internationally acclaimed materials scientist is co-PI on the renewal award and serves on the CNS Executive Committee and. Hawker is a full participant in decisions and planning for the CNS.
- **National Advisory Board (NAB):** The NAB of the CNS-UCSB was chaired until Dec 2008 by Tom Kalil, UC Berkeley, until he was drafted to join the Obama White House in science and technology policy. Current Board Co-Chair John Seely Brown is extensively involved in nanotech start ups and global nanotech development; the board also includes Rice University nanochemist and national center (CBEN) leader, Vicki Colvin, Harvard nanoscientist and NSEC director, Robert Westervelt, and engineer Susan Hackwood, an engineering professor and leading science policy expert in California as Director of the California Council on Science and Technology Policy.
- **Location and Proximity:** CNS-UCSB was until Nov 2009 partially located in the CNSI building, where our education staff interacted closely with theirs. In spite of current relocation out of the CNSI and into badly needed contiguous working and research space, our ties to CNSI continue, with partnering on undergrad intern program, the new curriculum development program, event publicity, and many other instances. CNS will continue to have full use of the CNSI, and MRL Director Hawker has also been generous in offering us space in his building as needed.
- **Research Program:** All IRGs of the CNS involve plans for fine grained social science research with nanoscientists and engineers at UCSB and elsewhere. We have collaborative ties with a number of researchers on campus, and we are successfully drawing top science graduate students as applicants to our Research Fellows program; and they come with the endorsement of their advisors, and requests for renewals, all strong evidence of the estimation of the CNS by our colleagues in science and engineering fields.
- **Research collaborations between CNS and nanoscientists and engineers:** CNS is a funded partner in the UC Center for Environmental Implications of Nanotechnology in which Director Harthorn leads the only social science IRG and serves on the Executive Committee. In addition, Harthorn has again for the past year collaborated with microbiologist Holden on the CNS/CEIN industry survey about safe handling practices for nano materials. CNS postdoc Johansson, a cross-IRG appointment, conducted lab ethnography in the NINN

facility on campus and CEIN toxicologists' labs. Director Harthorn also is collaborating with researchers at Oak Ridge National Laboratory in a proposed project involving 8 DOE national centers for nanoscience and technology research and development. Finally, CNS has partnered extensively with CNSI on funding proposals to extend the educational mission.

- **Education Program:** Our recruitment and summer internship programs are closely coordinated with 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), and the UC CEIN, among numerous others.

More directly, and as a result of extensive consultation with campus nanoscientists, the CNS has an interdisciplinary program of CNS Graduate Research Fellowships that involves nanoscale science and engineering graduate students (5 in the reporting year) and social science graduate students (8 in the reporting year) directly in CNS IRG research programs. Fellows work alongside and in close contact with other Fellows and with faculty researchers. Disciplinary differences inform student approaches to the weekly fellows meetings and IRG meetings, and mechanisms to supersede those differences are developed in the collaborative atmosphere fostered by the Center. All CNS Graduate Fellows take an active role in the research, as evinced by the 11 papers or chapters (published or accepted for publication) that CNS graduate students co-authored with CNS senior researchers in the last year. CNS Fellows were first author on three of these publications. UBC Engineering graduate student, Christian Beaudrie, was first author on an additional three publications.

Nanoscale S&E Fellows demonstrate an ongoing commitment to CNS, as witnessed by numerous requests for multi-year fellowships and ongoing participation in CNS events and activities even after the Fellowship term has ended for those who remain on campus. Ties are continuing even after NSE fellows leave campus.

As noted above, CNS also has key involvement in development and implementation of the INSCITES course, the *Nanoscience in Society* course at Santa Barbara Community College, and a similar course in the new Science and Math Initiative minor at the UCSB Gevirtz School of Education.

In all cases, the NSE community 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, and the numbers of interactions continue to grow over time. Support letters indicate the extent of this support and its importance to us.

National & International Nano Outreach: Weekly Clips

Another popular continuing outreach effort is the CNS-UCSB Weekly Clips. Leading breaking news stories on nanotechnology and societal issues are tracked and circulated electronically. Fifteen Weekly Clips compilations were sent out during the reporting period to a growing list of nearly 500 interested colleagues, students, government and policy people, industry contacts, NGO leaders and members of the general public. This program depends on talented but necessarily transitory effort by graduate student employees. UC CEIN has asked us to partner with them in disseminating environmental toxicity news as a part of this program.

Web Site

The CNS web site (www.cns.ucsb.edu) serves as the main portal for information dissemination to and contact with the various constituencies the CNS aims to serve and as such requires continual updating. Through this portal we aim to share the tools and resources generated for our own research, education and public outreach programs to a wider audience. Such

resources include: identification and links to other researchers and their interests; sharing of emergent publications and bibliographies in annotated and/or classified format; clipping service of public media coverage; all CNS reports and products; and educational resources from UC Santa Barbara and elsewhere, with necessary permissions, such as syllabi of nano-society courses.

The web has proven a useful tool for planning, organizing, and hosting key events. For example, a web presence for the Nov 2009 NanoEquity conference (nanoequity2009.cns.ucsb.edu) was critical in informing and recruiting participants, linking it clearly to wider CNS audiences. It is being used in similar fashion for the upcoming (Nov 2011) S.NET conference, co-hosted by CNS-UCSB and CNS-ASU.

In 2010 CNS made the strategic decision to focus on web-based outreach efforts in an attempt to reach audiences beyond the Santa Barbara community. Portals are under development for various audiences: secondary school teachers, general public, academic researchers, and policy makers. During summer 2010 the entire CNS website was migrated to a new, more robust platform (Drupal) that allows for easier content editing, thus decentralizing that function. Final migration to the new design format is expected by May 2011. The improved website allows for more effective interaction and information retrieval, including showcasing CNS research, and developing a rotating segment on student or other researchers' activities.

The CNS Web site is mounted on our host server in the UC Santa Barbara 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 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 Web site. The website links to a blog as well, hosted in the past primarily by PIs McCray and Newfield. Activity has diminished from modest to miniscule in the past year. CNS efforts have been redirected on the advice of our Board to following and contributing to blogs that are already well established (e.g., *Science Progress*, to which [McCray](#) has successfully contributed twice in the past year, and *2020 Science*, to which [Harthorn](#) has contributed in the past year).

Staffing the full web services needed for a NSF national center working on strategic issues in emerging technologies is a challenge both budgetarily and in terms of human resources. The skills and tools needed rarely reside in a single individual, and the Center's scale and operational resources do not permit hiring multiple different positions. In 2010 CNS redirected its effort to meet these needs not through permanent staff positions but through strategic use of on-campus services, student and temporary employees, and other approaches that will leverage our resources and location.

Media outreach

CNS has an active media objective of translating academic results to a general audience, using media contacts and dissemination processes. In 2010, CNS began to utilize campus information services to write and disseminate press releases about CNS activities, to contract web services from an on-campus unit and web updating from a student assistant employee, and to contract a graphic designer to provide services on an as-needed basis. The initial administrative costs of setting up these different contracts and service arrangements will be mitigated by having tailored professional services available but only on a cost effective as needed basis.

Educational Outreach Efforts

CNS is involved in the development and implementation of several new courses aimed at bringing nanotechnology and society issues to the classroom (see Education section for more details)

Former fellow, Dr. Meredith Conroy is teaching Cultural Studies Program 65, *Science Fiction, Biotechnology, and the Future of the Human Species* at Occidental College in Los Angeles, California. For her course she draws directly on materials from CNS. With CNSI, CNS developed an innovative education program providing graduate students in the sciences, engineering, and the social sciences to formulate a course for undergraduates that integrates nanoscience research (including labs) with the historical and social context in which this technology is being developed. INSCITES (Insights on Science and Technology for Society) funding was provided through an NSF Distinguished Teaching Scholar award to former CNSI Director and former CNS Associate Director for Nanoscience and Co-PI, Hu. CNS Co-PI McCray co-taught the INSCITES course. Though this program is no longer active, an NSF STS award at CNS, with Education Director Dilleuth as PI and McCray as co-PI, among others, began in January 2010 to update the nanotechnology content of the *Green Works: Technology and the Search for Sustainability* course and bring INSCITES to community colleges in collaboration with Santa Barbara City College. The GreenWorks course was re-worked into Physical Science 107, *Nanoscience in Society*. It is currently (Spring 2011) being taught by SBCC Chemistry Professor Eric Bullock and enrolls diverse majors from that campus. Further, CNS is part of the NSF CCLI award at the UCSB Gevirtz School of Education to teach the same course as part of their new Science and Math Initiative minor. In Fall 2010 Harthorn contributed a lecture module on societal implications of nanotechnologies for an on-line course offered through the UC CEIN and being further developed for dissemination in Mexico. CNS future education outreach plans include development of teaching modules for high schools based on CNS societal implications research.

CNS-UCSB Presentations 2010-2011

A. Education and Outreach (to NSE, industry, government, media, public) (n=66)

Satterfield, Terre. "Reflections on Chasing the Elusive: Hope, Intention and Disruption in the Anticipation of Social Response to Nanotechnologies," University of British Columbia, Vancouver, Canada, March 2, 2010.

Ridge, Claron. "The Graduate School Experience," San Roque School, Santa Barbara, CA, March 5, 2010.

Engeman, Cassandra, Lynn Baumgartner. "Preliminary Findings (videoconference)," Nanotechnology Colloquium, Applied Nanotechnology, Inc., (videoconference to) Austin, TX, March 8, 2010.

Harthorn, Barbara Herr. "The Past and Future of Responsible Development for Nanotechnologies," Session 13, Societal Dimensions of Nanotechnology, NNI Revisioning Nano2 conference, Evanston, IL, March 9-10, 2010.

Appelbaum, Richard and Bradley Chmelka. "New Nanoscale Materials for the Future of Energy: a community discussion," CNS-UCSB NanoMeeter, University Club, Santa Barbara, CA, March 11, 2010.

Dilleuth, Julie. "The Big Deal about Small Science: Nanotechnology in Society," NNIN Day in Science, UCSB, Santa Barbara, CA, March 24, 2010.

- Harthorn, Barbara Herr.** "How Nanotech Risk Perception Informs EHS Decision Making," Keynote address, NNCO EHS Capstone conference, Washington, D.C., March 30-31, 2010.
- Kandlikar, Milind.** "Risk Prioritization for Regulating Nanomaterials," Conference on Governing Nanobiotechnologies, University of Minnesota, Twin Cities, MN, April 2010.
- Baumgartner, Lynn, Ben Carr, Allison Fish, John Meyerhofer. "Industry Survey of Environmental Health and Safety Practices in the Nanomaterials Industry," Final Project Presentation, Bren Masters Group Project, Bren School, UCSB, Santa Barbara, CA, April 8, 2010.
- Engeman, Cassandra, Lynn Baumgartner. "Industry Survey, Presentation of Preliminary Findings," California Department of Toxic Substance Control (DTSC) visit, UCSB-CEIN, Santa Barbara, CA, April 15, 2010.
- Jennifer Rogers. "What is it Like to be a Postdoc?" Panel at UCSB Graduate Division, UCSB, Santa Barbara, CA, April 22, 2010.
- Johansson, Mikael. "What is it Like to be a Postdoc?" Panel at UCSB Graduate Division, UCSB, Santa Barbara, CA, April 22, 2010.
- Motoyama, Yasuyuki. "Untitled," Panel at UCSB Graduate Division, UCSB, Santa Barbara, CA, April 22, 2010.
- Dilleuth, Julie.** "Posters and Presentations: Guidelines, Skills, Tips," CEIN SPAC Meeting Poster Workshop, UCSB, Santa Barbara, CA, April 23, 2010.
- Engeman, Cassandra. "Industry Survey Presentation on Preliminary Findings," CEIN/CNS Earth Day, Santa Barbara Public Library, Santa Barbara, CA, April 24, 2010.
- McCray, Patrick.** "Vioneering: Histories of Radical Technical Optimism," Invited talk, Northwestern University-Qatar campus, Doha, Qatar, May 2010.
- Newfield, Chris.** "'Innovation Troubles' and blogging workshop," CNS seminar, CNS-UCSB, Santa Barbara, CA, May 11, 2010.
- Beaudrie, Christian. "Risk Assessment and Nanomaterial Regulation: A Life Cycle Investigation of Federal Health and Environmental Regulations," Conference, International Conference on the Environmental Implications of Nanotechnology (ICEIN), UCLA, Los Angeles, CA, May 11, 2010.
- D'Arcangelis, Gwen, Laura DeVries, **Terre Satterfield**, and **Barbara Herr Harthorn.** "Environmental Risk Perception: Surveying Public Response to Nanomaterials," Conference, International Conference on the Environmental Implications of Nanotechnology (ICEIN), UCLA, Los Angeles, CA, May 11-13, 2010.
- Engeman, Cassandra, Lynn Baumgartner. "Survey of International Nanomaterials Industry EH&S Practices and Perceptions," Conference, International Conference on the Environmental Implications of Nanotechnology (ICEIN), UCLA, Los Angeles, CA, May 11-13, 2010.
- Motoyama, Yasuyuki. "Analysis of Chinese Nanotechnology: Policies, Patents, and Publications," GIS for Disaster Planning and Response, Santa Barbara, CA, June 1, 2010.
- Engeman, Cassandra, Lynn Baumgartner. "Survey of International Nanomaterials Industry EH&S Practices and Perceptions," NSF Site Visit, UC CEIN, Los Angeles, CA, June 15, 2010.
- D'Arcangelis, Gwen, Laura DeVries, **Terre Satterfield**, and **Barbara Herr Harthorn.** "Environmental Risk Perception: Surveying Public Response to Nanomaterials," NSF Site Visit, UC CEIN, Los Angeles, CA, June 15-16, 2010.
- Newfield, Chris.** "Can the US National Innovation System work for Low- and Medium-Income Countries?" INRA, Ivry-sur-Seine, France, June 2010.
- Harthorn, Barbara Herr.** "Keynote Address," Conference, NIOSH Nanotech OHS & Medical Surveillance, Keystone, CO, July 21-23, 2010.

- D'Arcangelis, Gwen. "Masking the Risks of US Biodefense: 'Middle Eastern' Bioterrorists and Feminized Nationhood in US Bioterrorism Discourses," CNS seminar, CNS-UCSB, Santa Barbara, CA, July 28, 2010.
- Boone, Brent. "Framing and How it Affects Public Perception of Nanotechnology," Poster session, UCSB Summer Undergraduate Research Colloquium, Santa Barbara, CA, August 12, 2010.
- Jackson, Simone. "Nanotechnology in California," Poster session, UCSB Summer Undergraduate Research Colloquium, Santa Barbara, CA, August 12, 2010.
- Rajan, Sri Jay. "Assessing the High-Impact Contributions of Foreign-Born Scientists to Nanotechnology Evolution," Poster session, UCSB Summer Undergraduate Research Colloquium, Santa Barbara, CA, August 12, 2010.
- Santos, Nicholas. "The Geohistory of Nano Policy in the United States," Poster session, UCSB Summer Undergraduate Research Colloquium, Santa Barbara, CA, August 12, 2010.
- Dillemuth, Julie.** "Responsible Researchers: Local to Global Dimensions of Ethics in Science," Summer Intern Lecture Series, INSET, Santa Barbara, CA, August 3, 2010.
- Harthorn, Barbara Herr.** "Untitled" CEIN on-line course, Fall 2010.
- Pidgeon, Nick.** "Lessons from Nanotechnology Public Engagement and Policy impacts," Nanopodium, Amsterdam, Netherlands, September 17, 2010.
- Parker, Rachel. "Multi-Walled Carbon Nanotubes in Water Filtration Systems: From New Material Innovation to New Product Innovation," Innovation Day, Chemical Heritage Foundation, Philadelphia, PA, September 22, 2010.
- Jackson, Simone. "Nanotechnology in California," National Conference, SACNAS, Anaheim, CA, September 30-October 3, 2010.
- Mody, Cyrus.** "The Political Economy of the Knowledge Economy: Interdisciplinarity at Vietnam-Era Stanford," Invited workshop, Scientific Collaboration, Interdisciplinary Pedagogies and the 'Knowledge Economy', Oxford University, Oxford, United Kingdom, September 9, 2010.
- Holden, Patricia.** "UCSB Nanotechnology Industry Survey Overview: Nanomaterial Eco-toxicology Impacts," Nanotechnology VI: Progress in Protection conference, California Department of Toxic Substance Control (DTSC), Los Angeles, CA, October 13, 2010.
- Ridge, Claron. "The Graduate School Experience," Foothill Technology High School, Ventura, CA, October 16, 2009.
- Eardley-Pryor, Roger. "Presentation and discussion on a review of Nano2: Nanotech Long-term Impacts and Research, 2000-2020," Graduate Workshop in Sociological Research, UCSB, Santa Barbara, CA, October 20, 2010.
- Harthorn, Barbara Herr.** "Ambivalence, Uncertainty & Risk: Public Engagement with New [Nano]technologies," Inaugural faculty lecture, Globalizing Risk UCSB Faculty Lecture Series, Santa Barbara, CA, October 22, 2010.
- Mody, Cyrus.** "Interdisciplinarity and Vietnam-Era Protest at Stanford," Student Leadership Council, lunch talk series, Rice Center for Biological and Environmental Nanotechnology, Houston, TX, October 28, 2010.
- Herron, Patrick, Timothy Lenoir.** "Untitled," Data and Cognition Panel, Society for Literature, Science, and the Arts, Indianapolis, IN, October 28, 2010.
- Rajan, Sri Jay. "Assessing the High-Impact Contributions of Foreign-Born Scientists to Nanotechnology Evolution," Conference, Sigma Xi, Washington, DC, November 2010.
- Harthorn, Barbara Herr.** "Risk Perception and Environmental Health and Safety Practices in the Global Nanomaterials Industry," Anthropology/Environmental Science 130A: Coupled Human and Natural Systems, UCSB, Santa Barbara, CA, November 10, 2010.
- McCray, Patrick.** "History of Nanotech Policy," History 7: History of Public Policy, UCSB, Santa Barbara, CA, November 2010.

- Harthorn, Barbara Herr.** "Nanotechnology Environmental Health and Safety," CNS Seminar - Soc 591 BH, CNS-UCSB, Santa Barbara, CA, November 17, 2010.
- Engeman, Cassandra. "Reported Practices and Perceived Risks Related to Health, Safety, and Environmental Stewardship in Nanomaterials Industries," Guest presentation, Soc 591 BH, CNS-UCSB, Santa Barbara, CA, November 17, 2010.
- Beaudrie, Christian. "Lessons Learned from a Survey of Nanotechnology Experts," RMES 500s: Qualitative Methods in Interdisciplinary Contexts, University of British Columbia, Vancouver, BC, Canada, November 17, 2010.
- Eardley-Pryor, Roger. "Presentation on Use/Misuse of Nanotechnology in the 2008 Remake of The Day the Earth Stood Still (2008)," Graduate Workshop in Sociological Research, CNS-UCSB, Santa Barbara, CA, November 3, 2010.
- Beaudrie, Christian. "Technology and Sustainability?" Institute for Resources, Environment and Sustainability (IRES) Student-Led Seminar Series, University of British Columbia, Vancouver, BC, Canada, November 30, 2010.
- McCray, Patrick, Barbara Herr Harthorn.** "New Methods for Public and Other Stakeholder Participation," NNI and Societal Impact session, NSF Nanoscale Science & Engineering Grantees Conference, Arlington, VA, December 8, 2010.
- Choi, Hyungsub.** "Transistor States: Semiconductor Industry and the Government in the United States and Japan," Hagley Research Seminar, Hagley Museum and Library, Wilmington, DE, December 16, 2010.
- Motoyama, Yasuyuki. "Reflections on Competitiveness and Collaboration," CNS seminar, CNS-UCSB, Santa Barbara, CA, January 12, 2011.
- Conti, Joseph.** "The Regulation of Nanotechnologies: Regulators, Risk, and Global Governance," University of Wisconsin School of Law, Madison, WI, January 25, 2011.
- Satterfield, Terre.** "Rethinking Risk at the Intersection of Culture, Justice and Governance," Centre for Environment and Sustainability, University of Western Ontario, London, Ontario, Canada, February 3, 2010.
- Harthorn, Barbara Herr.** "Co-organizer," Life Cycle Assessment of Nanomaterials Workshop, UC Center for Environmental Implications of Nanotechnology (CEIN), Santa Barbara, CA, February 7, 2011.
- Beaudrie, Christian. "Risk Assessment and Nanomaterial Regulation: A life cycle investigation of federal health and environmental regulations (discussant)," Life Cycle Assessment of Nanomaterials Workshop, UC Center for Environmental Implications of Nanotechnology (CEIN), Santa Barbara, CA, February 7, 2011.
- Harthorn, Barbara Herr.** "Focus Groups and Deliberation," Guest Lecture, FemSt 260: Feminist Research Methods, Feminist Studies Dept, UCSB, Santa Barbara, CA, February 9, 2011.
- McCray, Patrick.** "Perspectives on HeLa: A Cross-Disciplinary Discussion with Faculty," UCSB Reads, UCSB, Santa Barbara, CA, February 15, 2011.
- Appelbaum, Richard.** "China's Rise as a High-Tech Power: Challenges and Opportunities," Centre for Human Rights, University of Hyderabad, Hyderabad, India, February 21, 2011.
- Appelbaum, Richard.** "China's Rise as a High-Tech Power: Challenges and Opportunities," Brainstorming Workshop on Prospects of Nanotechnology in Agri-value Chain, National Academy of Agricultural Resource Management, Hyderabad, India, February 22, 2011.
- Appelbaum, Richard.** "China's Rise as a High-Tech Power: Some Implications for U.S. Foreign Policy," Santa Barbara Institute on World Affairs, inaugural event, Lobero Theater, Santa Barbara, CA, February 26, 2011.
- Frederick, Stacey. "A Value Chain Research Approach to Nanotechnology: a Framework for Competition and Collaboration," CNS seminar, CNS-UCSB, Santa Barbara, CA, March 2, 2011.

Mehta, Aashish, "International Collaboration and Paper Impact in Nanotechnology," CNS seminar, CNS-UCSB, Santa Barbara, CA, March 9, 2011.

Hawker, Craig. "Keynote address," Top-down Meets Bottom-up at Foundations of Nanoscience meeting (FNANO), International Society for Nanoscale Science, Computation, and Engineering, Snowbird, UT, April 11-15, 2011.

Santos, Nicholas. "The Geohistory of Nano Policy in the United States," Poster session, Association of American Geographers, Seattle, WA, April 12-16, 2011.

B. Research Presentations (n=50)

Beaudrie, Christian, Milind Kandlikar, Terre Satterfield & G. Ramachandran. "Using Risk Ranking and Reasoning by Analogy for Nanoparticle Risk Assessment and Standard Setting," Annual Meeting, Society for Risk Analysis, Baltimore, MD, December 8, 2009.

Choi, Hyungsub. "Semiconductor Technology Licensing in the 1950s," Forum on Innovation Studies, Hitotsubashi University, Tokyo, Japan, March 9, 2010.

Johansson, Mikael. "Working for Next to Nothing: Labor in the Global Nanoscientific Community," Annual Meeting, Society for Applied Anthropology, Merida, Yucatan, Mexico, March 24-27, 2010.

Rogers, Jennifer, **Barbara Herr Harthorn**, Christine Shearer, and Tyronne Martin. "Engaging the Citizenry: US Publics' Values and Perceptions Regarding Emerging Nanotechnologies for Energy and the Environment," Annual Meeting, Society for Applied Anthropology, Merida, Yucatan, Mexico, March 24-27, 2010.

Barnett, Gerald. "Third Generation Technology Transfer," States of Innovation Conference, CNS-UCSB, Lyon, France, April 2010.

Boudreaux, Daryl. "Innovation Needs for Nanoenabled Solar Energy Systems," States of Innovation Conference, CNS-UCSB, Lyon, France, April 2010.

McCray, Patrick. "Spinning Innovation," States of Innovation Conference, CNS-UCSB, Lyon, France, April 2010.

Mowery, David. "Innovation Systems at the Crossroads: Comparative International Conditions," States of Innovation Conference, CNS-UCSB, Lyon, France, April 28-30, 2010.

Newfield, Chris. "Could a Better Public Narrative Help Solar Energy?" States of Innovation Conference, CNS-UCSB, Lyon, France, April 1, 2010.

Newfield, Chris. "Introduction: An Innovation Crisis," States of Innovation Conference, CNS-UCSB, Lyon, France, April 1, 2010.

Rogers, Jennifer, Christine Shearer, **Barbara Herr Harthorn**. "GM and Nano in our Food: Public Perceptions, Reactions, and Movements," Meeting, Pacific Sociological Association, Oakland, CA, April 10, 2010.

Beaudrie, Christian. "Risk Assessment and Nanomaterial Regulation: A Life Cycle Investigation of Federal Health and Environmental Regulations," Conference, Greener Nano 2010, Portland, OR, June 16, 2010.

Corner, Adam. "Untitled," Society for Risk Analysis, London, United Kingdom, June 23, 2010.

Pidgeon, Nick. "Keynote Address," Society for Risk Analysis, London, United Kingdom, June 23, 2010.

Johansson, Mikael. "'Risky business' – How Toxicologists Negotiate the Potential Danger of Nanoparticles," World Congress, International Sociological Association, Gothenburg, Sweden, July 11-17, 2010.

Engeman, Cassandra, Lynn Baumgartner, **Patricia Holden**, and **Barbara Herr Harthorn**. "Reported Practices and Perceived Risks Related to Health, Safety and Environmental Stewardship in Nanomaterials Industries," World Congress, International Sociology Association, Gothenburg, Sweden, July 13, 2010.

- Appelbaum, Richard**, Rachel Parker. "Emerging Technologies/ Emerging Economies: Prospects for More Equitable Development in Energy, Water, Food Security, and Health," World Congress, International Sociological Association, Gothenburg , Sweden, July 15, 2010.
- Rogers, Jennifer, **Barbara Herr Harthorn**, Christine Shearer. "Visions of Nanotech Futures: A Feminist Analysis of Nanotechnology Deliberative Workshops," World Congress, International Sociology Association, Gothenburg, Sweden, July 15, 2010.
- Rogers, Jennifer, Christine Shearer, **Barbara Herr Harthorn**. "Deliberating Risks: Public Perceptions Regarding Nano Food and Agricultural Applications," Annual Meeting, Rural Sociological Association, Atlanta, GA, August 15, 2010.
- Rogers, Jennifer. "Maíz y País: Indigenous Mexican Struggles Against Biotechnology in Agriculture," Annual Meeting, American Sociological Association, Atlanta, GA, August 17, 2010.
- Johansson, Mikael. "Why Everybody Loves Nanotechnology," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 25-29, 2010.
- Choi, Hyungsub**. "The Spatiality of Materials Science," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 26, 2010.
- Choi, Hyungsub**. "Micro-Histories and Nano-Futures Session (Presenter, Chair, Organizer)," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 26, 2010.
- Gray, Summer. "From Substance to Appearance: The Question of Interdisciplinarity and Nanotechnology in the US," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 26, 2010.
- Mody, Cyrus**. "From Microscience to Nanotechnology, 1970-2000," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 26, 2010.
- McCray, Patrick**. "Two-Part Harmony: Nanotechnology's Early Communities of Support," Annual Meeting, Society for Social Studies of Science, Tokyo, Japan, August 26, 2010.
- Motoyama, Yasuyuki. "Bridging Science and Innovation? A Case Study of U.S. National Nanotechnology Initiative," Technologies in Public Sphere, Society for Social Studies of Science, Tokyo, Japan, August 27, 2010.
- Newfield, Chris**. "Nanotechnology, Quantum Dots, and Open Source," Nanorama, Lorient, France, September 2010.
- Conroy, Meredith. "A Psychology of Framing: The Effects of Personality on Susceptibility to Media Frames," Annual Meeting, American Political Science Association, Washington, D.C., September 4, 2010.
- Harthorn, Barbara Herr**, Jennifer Rogers, Christine Shearer. "Paradoxes of Development: Techno-Enthusiasm and Skepticism in US Nanotech Deliberation," Annual Meeting, Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, September 29-October 2, 2010.
- Mody, Cyrus**. "Untitled (Panel Participant)," Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, September 30, 2010.
- Gray, Summer, Nicholas Santos. "The Geohistory of Nano Policy in the United States," Annual Meeting, Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, September 30, 2010.
- Eisler, Matthew. "Making Nanomaterials Work in Energy Conversion," Annual Meeting, Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, October 1, 2010.
- Newfield, Chris**. "Is Nanotechnology Changing Technology Transfer?" Annual Meeting, Society for the Study of Nanoscience and Emerging Technologies (S.NET), Darmstadt, Germany, October 2010.
- Mody, Cyrus**. "Leo Marx Meets Some New Reader," Society for the History of Technology, Tacoma, WA, October 2, 2010.

- D'Arcangelis, Gwen. "Public Risk Perception of Environmental Risks of ENMs and Environmental Justice," Annual Meeting, National Women's Studies Association, Denver, CO, November 12, 2010.
- Satterfield, Terre.** "Reflections on Chasing the Elusive: Hope, Intention and Disruption in the Perception of Nanotechnologies," Annual Meeting, American Anthropological Association, Philadelphia, PA, December 4, 2010.
- Harthorn, Barbara Herr, Nick Pidgeon, Terre Satterfield.** "What's New About Nano? Nanotechnology Risk Perception Specialist Meeting Jan 2010," Annual Meeting, Society for Risk Analysis, Salt Lake City, UT, December 5-8, 2010.
- Harthorn, Barbara Herr.** "Chair: Nothing New About Nano? Making Interdisciplinary Advances in Risk Perception Research," Annual Meeting, Society for Risk Analysis, Salt Lake City, UT, December 5-8, 2010.
- Satterfield, Terre, Joseph Conti, Barbara Herr Harthorn, et al.** "Exploring the Prehistory of Risk Perceptions: Malleable Perceptions and Upstream Study of the Perceived Risks of Nanotechnology," Annual Meeting, Society for Risk Analysis, Salt Lake City, UT, December 8, 2010.
- Satterfield, Terre, Adam Corner, Nick Pidgeon, and Barbara Herr Harthorn.** "Affective Ambivalence and Nanotechnologies," Annual Meeting, Society for Risk Analysis, Salt Lake City, UT, December 8, 2010.
- Beaudrie, Christian, **Terre Satterfield, Milind Kandlikar, Barbara Herr Harthorn.** "Benefits, Risks, and Regulation of Nanomaterials: Results from an Expert Survey," Annual Meeting, Society for Risk Analysis, Salt Lake City, UT, December 8, 2010.
- McCray, Patrick.** "Timothy Leary's Transhumanist SMI2LE," Groovy Science: The Counter-Cultures and Scientific Life, 1955-1975, Princeton University, Princeton, NJ, February 5, 2011.
- Mody, Cyrus.** "An Electro-Historical Focus with Real Interdisciplinary Appeal: Interdisciplinarity at Vietnam-Era Stanford," Groovy Science: The Counter-Cultures and Scientific Life, 1955-1975, Princeton University, Princeton, NJ, February 5, 2011.
- Appelbaum, Richard.** "China's Rise as a High-Tech Power: Challenges and Opportunities (invited speaker)," Giri Deshingkar Memorial Lecture, India International Centre, University of Delhi, Delhi, India, February 16, 2011.
- Appelbaum, Richard.** "China's Rise as a High-Tech Power: Some Implications for U.S. Foreign Policy," School of International Studies, Jawaharlal Nehru University, Delhi, India, February 18, 2011.
- Copeland, Lauren. "Conceptualizing Political Consumerism," Communication, Consumers, and Citizens: Revisiting the Politics of Consumption, University of Wisconsin-Madison's Consumer Culture and Citizen Participation, Madison, WI, March 4, 2011.
- Copeland, Lauren, **Bruce Bimber, Homero Gil de Zuniga.** "Social Media Use and Purposeful Consumerism," Communication, Consumers, and Citizens: Revisiting the Politics of Consumption, University of Wisconsin-Madison's Consumer Culture and Citizen Participation, Madison, WI, March 4, 2011.
- Harthorn, Barbara Herr.** "Keynote: Health Enhancement and Hazard Posed by New [Nano]Technologies," Cascadia Seminar: Ethnographic Adventures in Medical Anthropology, University of Washington, Seattle, WA, March 4-6, 2011.

13. SHARED AND OTHER RESEARCH FACILITIES

The infrastructure needs for the societal implications research of CNS-UCSB are well met through UCSB and partner organizations.

1) CNS-UCSB

The main facilities for CNS in the first award period were a set of research and administration offices at UCSB in North Hall and the California NanoSystems Institute. The dispersed location of these offices was not ideal for running a collaborative interdisciplinary center. Beginning in late Nov 2009, the CNS relocated to a suite of contiguous offices, for all CNS personnel, providing proximity of researchers with staff and infrastructure and a suitable conference and meeting space. The CNS site is in a centrally located building on campus that allows more effective coordination and communication among all participants. This commitment of space by the Executive Vice Chancellor, College of Letters and Science, and Dean of Social Sciences to the CNS on our very space-constrained campus is a strong mark of support for our interdisciplinary research and education efforts. In 2011, the College of Letters and Science has generously provided an additional contiguous office to accommodate the needs of CNS' numerous visiting scholars and researchers. We continue to have access as needed to additional space for meetings, conferences, seminars, and other gatherings in the Institute for Social, Behavioral & Economic Research (ISBER) in North Hall. ISBER additionally provides the organized research infrastructure for CNS through computing network infrastructure for our offices and our work, secure sites on the server for our collaborative sharing of project data, and many forms of research administration support that augment our administrative capacity.

2) California NanoSystems Institute (CNSI)

The UCSB CNSI offers a unique set of resources that contribute to the collaborative, interdisciplinary nature of the Center. Completed early in the first award period, CNSI is a dedicated Institute building that serves as a state-of-the-art laboratory facility and hub for many of the nanoscientists and engineers working on campus. It includes a consolidated Nanostructures Imaging and Characterization Laboratory, equipped with NMR, electron microscopes, scanning probe tools, optical and electrical characterization and surface analysis capability. A BioNanofabrication facility will complement the existing NNIN facility --11,000 sq. ft. cleanroom (see below) by focusing on new chemical and biologically-templated means of forming nanostructured devices. The CNSI building also houses the Allosphere, a 360 degree, 3-story data-visualization space, and extensive exhibition space that accommodates travelling nano science education exhibitions and public engagement events. These spaces are important sites for CNS's partnered education programs with CNSI. Although CNS no longer occupies office space in the CNSI building, the foundation created by our partnerships with CNSI education personnel and co-residence with them for several years will endure, and we continue to use CNSI conference and meeting spaces for seminars, lectures, and other events to increase our visibility and engagement with the NSE community. More information on CNSI, the MRL, and UCSB nanoscale shared research facilities can be found at www.cnsi.ucsb.edu.

3) Materials Research Laboratory (MRL) (UCSB)

MRL was established in September 1992 with funding from the National Science Foundation (NSF), and became an NSF Materials Research Science & Engineering Center (MRSEC) in 1996. The research, scientific and engineering activities of the Materials Research Laboratory focus on educational outreach and four major interdisciplinary research groups (IRGs), as well as six laboratories. MRL also runs the IGERT program ConvEne — Conversion of Energy Through Molecular Platforms, an interdisciplinary approach to graduate education aimed at providing a new generation of Chemical Scientists and Engineers with the technical skills,

environmental awareness, business expertise, and teamwork approaches that will be required to address fundamental and applied issues in the generation and conversion of energy in efficient and environmentally-sustainable ways. The Director of MRL, Craig Hawker, is a co-PI of the Center's NSEC award and a member of the CNS Executive Committee. MRL Education staff coordinate a campus-wide summer Undergraduate Research Intern Seminar Series, which CNS interns attend and in which CNS Education staff and faculty have presented.

<http://www.mrl.ucsb.edu>

4) Nanotech: The UCSB Nanofabrication Facility, National Nanotechnology Infrastructure Network (NNIN) (UCSB)

UCSB has extensive facilities and research in nanotechnology. Specific UCSB strengths include leading expertise in compound semiconductors, photonics, quantum structures, and expertise with non-standard materials and fabrication processes. The nanofabrication facility has comprehensive and advanced semiconductor and thin film processing equipment and provides access and professional consultation to industrial and internal and external academic users. The facility currently consists of 12,700 sq ft of clean space. Both on-site and remote support of users (including equipment training, process consultation, and remote job processing) is provided by a staff of six engineers supporting facilities and three Ph.D.-trained engineers supporting process. The Nanofabrication Facility has been a resource for CNS ethnographic research of laboratory culture, and new partnerships with Education staff that bring CNS expertise to NNIN Societal and Ethical Issues education programs are expanding our reach to new audiences. <http://www.nanotech.ucsb.edu/>

5) Center for Spatial Studies (spatial@ucsb)/National Center for Geographic Information and Analysis (NCGIA)/Center for Spatially Integrated Social Science (CSISS) (UCSB)

The Center for Spatial Studies, NCGIA, and CSISS (housed within NCGIA) together form a cluster of internationally renowned knowledge, mapping resources and personnel for spatial analytic scientific work. Given the global scope of CNS' research, the interest in tracking flows (such as the movement of goods services, and ideas through the global value chain), and the attraction of spatial data visualizations as a means of enhancing participation and knowledge exchange, the spatial resources at UCSB, and CNS's close connection to them constitute significant resources. CNS PIs Harthorn and Appelbaum are former executive committee members of CSISS (a NSF-funded social science infrastructure center), and the new spatial center's director, Michael Goodchild, is a key advisor and resource for the CNS. In its new configuration, spatial@ucsb, the center provides free consulting services on GIS, cartographic and other spatial research. CNS has drawn GSRs (Glennon, Hurt) and a fellow (Hurt) from CSS, and CNS has a firm commitment to incorporating cartographic and spatial analysis in the data analysis and data visualization phases of our research. In the renewal period, as CNS generates more databases adequate for spatial statistics we anticipate even closer ties with this cutting edge resource and the tools it provides. CNS in years 2010-2014 has a dedicated spatial analysis postdoc position, beginning in 2010. (See <http://www.spatial.ucsb.edu>; www.ncgia.ucsb.edu and www.csiss.org.)

6) Social Science Survey Center (SSSC) (ISBER, UCSB)

The SSSC/Benton Survey Research Laboratory at UCSB enhances interdisciplinary collaboration on theoretical and methodological planes. The SSSC is directed by sociologist John Mohr, a senior researcher in the CNS who has worked with both IRG 3 and IRG 2, and Associate Director, sociologist Paolo Gardinali. It is now housed in a generous space in the new social science building on campus and administered by ISBER and includes equipment and resources to conduct state-of-the art computer assisted interviewing system (CATI) telephone surveys, sophisticated web-based surveys, and mail and multi-mode surveys on local, regional,

or national populations in several languages. The SSSC works in extending traditional data collection methods with the use of online-based questionnaires for quantitative and qualitative data collection, in survey and experimental settings. The SSSC has also pioneered a cutting edge use of mixed data collection modes, using telephone, mail and web for maximum effectiveness. Extensive consulting is available on survey instrument design and development, programming, and data analysis and interpretation, and the SSSC is developing full GIS capability. Data security is a top priority, and multiple backups ensure stable system performance. SSSC provides support services for CNS deliberative workshops, web and phone survey, and data analysis consulting. Campus research services infrastructure greatly reduce the cost of such data acquisition while providing a reliable and IRB-safe mode. CNS has used SSSC services for full survey services or components of projects. For more information see <http://www.survey.ucsb.edu>

7) Center for Information and Technology (CITS) (UCSB)

CITS is dedicated to research and education about the cultural transitions and social innovations associated with technology, particularly in the highly dynamic environments that seem so pervasive in organizations and societies today. They also work to improve engineering through infusing social insights into the innovative process. CITS was founded at UC Santa Barbara in 1999, on the thirtieth anniversary of the birth of the Internet, through the efforts of founding director Bruce Bimber, also a senior researcher and executive committee member in the CNS. CITS research initiatives range from ground-breaking research on social computing, to the role and effectiveness of technology in the classroom, to the role of technology in organizing community events. In addition to research, CITS also supports an optional Technology and Society Ph.D. emphasis, which is available to students in participating doctoral programs at UCSB from the College of Engineering, the Social Sciences, and the Humanities. The emphasis provides interdisciplinary training on the relationships between new media and society with intensive faculty involvement. CITS serves as a close partner on graduate recruiting, shared programming, and other interests in common. CNS PIs Harthorn, Bimber and McCray are all affiliated faculty in CITS, collaborator Earl is a former director, and current director Flanagan confers regularly with the CNS executive committee. Longterm plans for the CNS include collaborative institutionalization with CITS. <http://cits.ucsb.edu/>

8) Bren School of Environmental Science and Management (UCSB)

The Bren School is among a handful of schools in the United States and the only one in the West that integrates science, management, law, economics, and policy as part of an interdisciplinary approach to environmental problem-solving. The school is housed in what was the "greenest" laboratory facility in the United States when it was completed in 2002, and in 2009 it became the first building to receive a second LEED Platinum certification, this time in recognition of maintenance and operations of an existing building. Bren Hall is home to a collection of superbly equipped laboratories, computer centers, lecture halls, and other teaching and meeting places that support instruction, research, interaction, and the development of tomorrow's most capable scientists and environmental managers. Bren School faculty and colleagues at UCSB (including CNS researchers), UCLA, and other universities began a 5-year, \$24 million nanotechnology risk-assessment project funded by the National Science Foundation (NSF) and the U.S. Environmental Protection Agency (EPA), in which CNS IRG 3 researchers have an active, funded role. The **UC Center for the Environmental Implications of Nanotechnology (UC CEIN)** is the nation's first such large-scale study of the potential ecological effects of nanomaterial forms. Bren School microbiologist Holden has been a collaborator with CNS IRG 3 since 2006. <http://www.bren.ucsb.edu>

9) The University of California Center for Environmental Implications of Nanotechnology (UC CEIN)

The University of California Center for Environmental Implications of Nanotechnology (UC CEIN) was established in 2008 with funding from the National Science Foundation and the U.S. Environmental Protection Agency to explore the impact of engineered nanomaterials on a range of cellular lifeforms, organisms and plants in terrestrial, fresh water and sea water environments. The UC CEIN integrates the expertise of engineers, chemists, colloid and material scientists, ecologists, marine biologists, cell biologists, bacteriologists, toxicologists, computer scientists, and social scientists to create the predictive scientific platform that will inform us about the possible risks and safe design of nanomaterials (NMs) that may come into contact with the environment. CNS-UCSB Director Barbara Harthorn leads UC CEIN IRG 7 - Risk Perception of Potential Environmental Impacts of Nanotechnology.

The UC CEIN is housed within the California NanoSystems Institute (CNSI) at UCLA, with a second major hub at the University of California, Santa Barbara. The Santa Barbara facilities include office, lab, meeting, and classroom space in the UCSB Bren School of Environmental Science and Management, research offices in CNS, and administrative and computing facilities within the Earth Research Institute (ERI) at UCSB. <http://www.cein.ucla.edu/>

10) Center on Globalization, Governance, and Competitiveness (CGGC) (Duke University)

This Center, led by CNS IRG 4 collaborator, Gary Gereffi, was created to address one of the key challenges of the contemporary era: to harness the potential advantages of globalization to benefit firms, countries, and organizations of all kinds that are trying to maintain or improve their position in the international arena. It does so by creating a comprehensive research framework that links the global, national, and local levels of analysis, translating research into appropriate organizational strategies and government policies. Its goal is to draw on a widespread, interdisciplinary network of scholars to formulate creative solutions for firms, countries, and organizations that want to improve their competitiveness or forge better development policies. It draws on the experience and expertise of the Rockefeller Foundation's Global Value Chains Initiative, assembling interdisciplinary, international groups of researchers with deep expertise on a broad range of industries affected by globalization. The Center's first three priority areas are China, India, and Mexico. The Center provides essential intellectual contributions to IRG 2's work on nanotechnology, globalization and E. Asia, as well as to the CNS undergraduate education program's project of the Global Value Chain. CNS spatial postdoc Frederick is combining GVC expertise gained in work with the CGGC with spatial analytic approaches to examine nanotech in the US and California (and across the global value chain). See <http://www.cggc.duke.edu/>

11) Chemical Heritage Foundation (CHF), Philadelphia

The Chemical Heritage Foundation is a library, museum, and center for scholars. Located in Philadelphia, CHF maintains world-class collections, including instruments and apparatus, rare books, fine art, and the personal papers of prominent scientists, all related to the chemical and molecular sciences. CHF also hosts conferences and lectures, supports research, offers fellowships, and produces educational materials. Their programs and publications provide insight on subjects ranging from the social impact of nanotechnology to alchemy's influence on modern science. CHF is the former base of CNS IRG 1 collaborator, Cyrus Mody, and current home to IRG 1 collaborator Hyungsub Choi. CHF is a generous partner in CNS's production of *oral histories* of leading nanoscientists, hosts key nano in society workshops and conferences, in which CNS has been a welcome participant, and currently partners with CNS in the publication of a series of commissioned research briefs, including some involving CNS researchers (Beaudrie, 2010; Mody, 2010; Parker, 2010;). <http://www.chemheritage.org/>

12) The Jenkins Collaboratory, Duke University is Tim Lenoir's a laboratory for developing technologies in contemporary science, engineering, and medicine, and their social and ethical implications. Their work focuses particularly on the current fusion of biotechnology, nanotechnology, and information technologies, and the transformative possibilities of this fusion for biomedicine, human-machine engineering, cultural production, and civic engagement. The Jenkins Collaboratory has several computer lab spaces and offices/workspaces as well as dedicated server space on the Duke campus. <http://www.jhfc.duke.edu/jenkins/>

13) The Institute for Resources, Environment and Sustainability (IRES) at the University of British Columbia (UBC)

The Institute for Resources, Environment and Sustainability (IRES) is an issue-driven interdisciplinary research institute with interest and expertise in a wide range of environment and sustainability issues. IRG 3 researchers Terre Satterfield and Milind Kandlikar serve as core faculty in the Institute, which *fosters sustainable futures through integrated research and learning about the linkages among human and natural systems, to support decision making for local to global scales*. IRES is home to a major interdisciplinary graduate education program (RMES) with 80 doctoral and 40 master students. Located within the Aquatic Ecosystems Research Laboratory (AERL) on the Main Mall of UBC's Vancouver campus, IRES facilities include office space, meeting facilities, classroom space, study space, and computing.

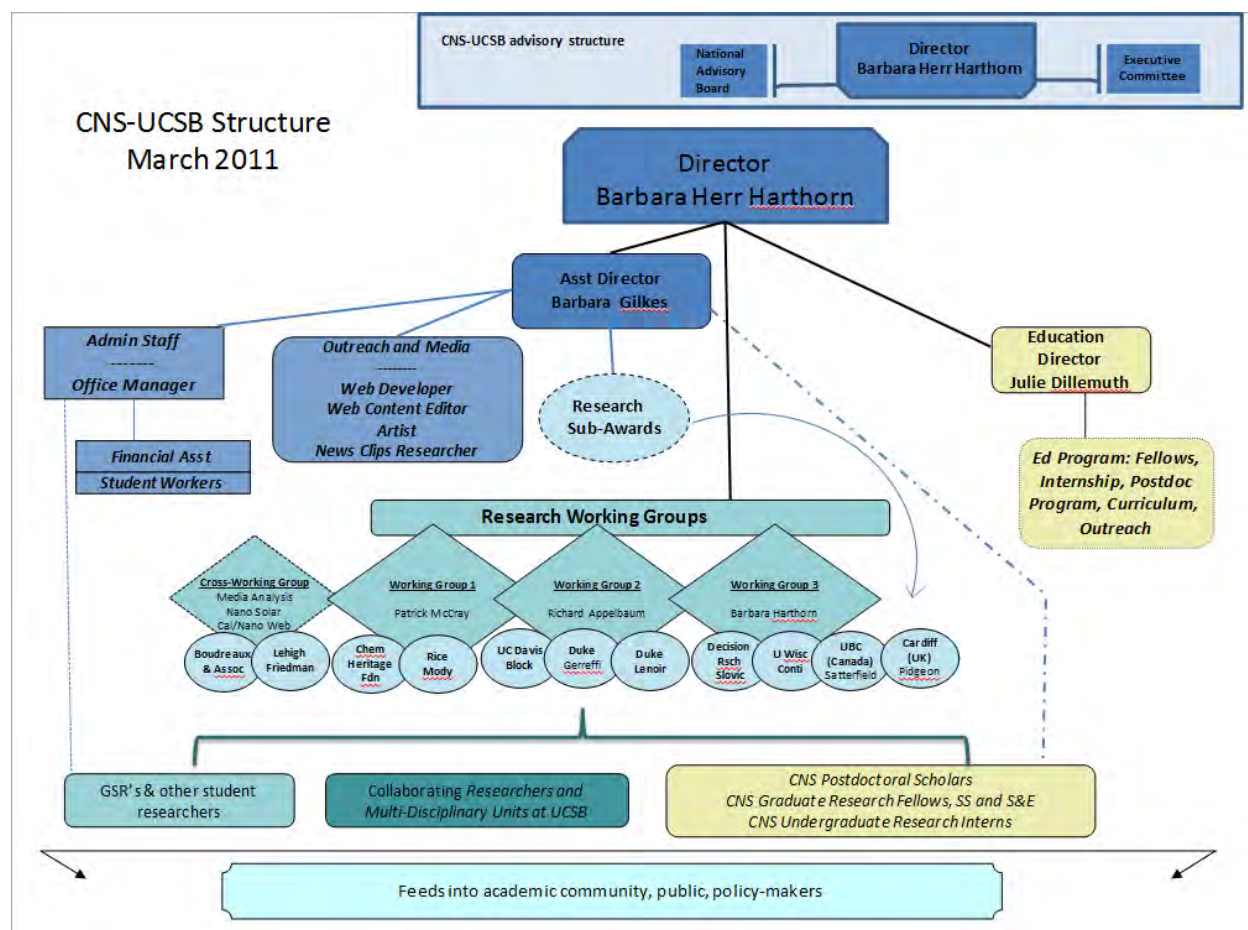
14) Science Journalism program/ Lehigh University

Through Lehigh University's Journalism & Communication department, CNS collaborator Sharon Friedman directs the Science Writing Program, which prepares bachelor's degree students to write for such science fields as engineering, medicine, scientific research and environmental sciences, and contains a media analysis component. Friedman, along with a professional researcher and student researchers, utilize facilities in Coppee Hall on the Lehigh campus in Bethlehem, PA.

14. PERSONNEL

CNS-UCSB is a single campus center, based firmly at University of California at Santa Barbara, taking full advantage of its renowned reputation for interdisciplinarity, its stellar materials science and engineering capabilities (MRSEC, top ranking Engineering College, California NanoSystems Institute, NNIN site, 2 Nobel laureates in the field), dedicated institutional commitment to diversity at all levels of leadership, and a strong team of interdisciplinary social science and humanities scholars to provide the core for CNS. CNS-UCSB Director Barbara Herr Harthorn works in collaboration with an Assistant Director (1.0 FTE), an Education Director (.65 FTE), a Financial Analyst/Events Coordinator (1.0 FTE), a Travel and Purchasing Administrative Assistant (.5 FTE, increased to 1.0 FTE in March 2011), and a Computing Specialist (.25 FTE). Harthorn is assisted by 4 co-PIs (Appelbaum, Bimber, McCray, and MRL Director Hawker) on the CNS Executive Committee, on which the CNS Assistant Director and Education Director serve *ex officio*. The 3 IRG leaders (McCray, Appelbaum, and Harthorn) are all based on the UCSB campus, share research space with and meet frequently with their IRG research teams. Thus, IRG leaders integrate their research issues and needs through the Exec and senior researcher meetings and seminars.

Director 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 lead PI, Dr. Harthorn also represents the CNS in NSF Nanotechnology in Society Network and NSEC interaction. The CNS Executive Committee meets monthly on a face to face basis, dialing in those who may be off site, and electronic and ftf communication takes place frequently on matters practical and intellectual.



Changes in the current reporting period

Executive Committee

This reporting period included the transition to the renewal award, beginning in Sept 2010. Dr. Craig Hawker, Director of the UCSB Materials Research Laboratory (MRSEC) and Professor of Chemistry and Materials, took over Evelyn Hu's place as a CNS co-PI. Hawker remains a member of the CNS executive committee, in which capacity he has served since Dec 2008. Dr. Hawker came to UCSB in 2004 after 11 years as a scientist at the IBM Almaden Research Center in San Jose, CA. He brings to the CNS a distinguished career, industry as well as academic experience, and a commitment to solving energy problems through technological development. His involvement has enabled new connections for the CNS on the engineering and physical side of campus (for example with the MRL IGERT), and we are grateful for his continued willingness to contribute time and effort to the CNS. Opting to serve a third year in France for the University's Education Abroad Program, Dr. Chris Newfield rotated off the CNS Executive Board in summer 2010.

Staffing

This has been a year of stability and capacity-building for CNS administrative staff, and the resultant consistency has benefited the research and education efforts.

(i) As CNS activities mature and proliferate, it has become necessary to increase the financial assistant from half-time to full-time. Incumbent Sage Briggs accepted this position and moved to full-time status with the Center in March 2011.

(ii) Assistant Director. In 2008, with strong NSF support, CNS added a new senior staff position to provide executive level assistance to the Director, stable day-to-day management of the center during the Director's frequent travel, coordination of the many facets of CNS duties, and supervision of staff. Assistant Director Barbara Gilkes has brought extensive university and international managerial experience to the position. Under the restructuring in 2010, the Assistant Director additionally assumed a central role in the Center's media and outreach programs and has anchored the Education and Outreach program during the Education Director's 3-month leave in 2011. Asst Director Gilkes manages the Center's sub-awards and professional services agreement and aptly handles the increased administrative complexity as CNS has increased its research network to 18 institutions beyond UCSB.

(iii) Dr. Julie Dillemath continues in the position of CNS Education Director, but beginning Jan 2011 has reduced her effort to .5 FTE. During Dillemath's family leave Jan-March 2011 CNS employed a .25 FTE replacement (Rebich Hespanha) to provide coordination of CNS Education Programs. During the reporting year, Dr. Dillemath worked with Co-PI McCray and others in successfully raising co-funding from NSF for a new curriculum development project that will more closely link CNS, CNSI and a local community college, SBCC, and meet NNI goals for workforce development by developing a community college course that embeds societal dimensions in nanoscience education. Dr. Dillemath is the lead PI on this initiative, and the course is underway during SBCC's spring semester.

(iv) In the past year, following the full changeover of the center's accounting system, Center Administrator Shawn Barcelona has now taken the lead on CNS accounts management and event coordination. She has added basic training sessions and socialization of postdocs into responsible grant management.

CNS leverages NSF resources in a number of ways to achieve savings without sacrificing capability. UCSB cash contribution to the CNS covers a significant portion of staff salaries and fringe benefits. CNS staff draws regularly on the expertise of the staff of CNS' immediate control point, the Institute for Social, Behavioral, and Economic Research, for assistance in all aspects of extramural award submissions and administration, accounts management, personnel action, travel accounting, purchasing, and computer network administration. ISBER's support has enabled CNS to achieve efficiencies in a number of areas, providing backup to CNS' smaller, more specialized staff. In addition, the CNS shares computer technology staffing with ISBER, which gives the CNS access to versatile skills when needed, without having to commit full-time salary expenditures. CNS has networked and further draws from expertise on the UCSB campus by contracting specific tasks (e.g., re-building the web platform, disseminating press releases, print design) to on-campus specialists.

National Advisory Board

CNS has had since inception an excellent National Advisory Board comprised of leading STS and social science scholars and members from industry, NSE, NGOs, policy, and others (see the full list in Section 4B). Board members **John Seely Brown** and **Ann Bostrom** currently serve as Co-Chairs. Beginning in 2010 the board will reduce from annual to biannual meetings

in Santa Barbara with CNS Executive Committee members, staff, researchers, and students to discuss CNS research, education and outreach efforts, assess new opportunities, and consider possible course adjustments in response to them. The board serves as an informal evaluation mechanism, as a sounding board for brainstorming new ideas and new directions, as a means to elicit elite views from a range of stakeholders in nanotechnology's societal impacts. This has been highly successful to date, and CNS plans no changes to this basic approach. The most current Board meeting is scheduled for April 4, 2011. Board members are willing and available for consultation by phone and e-mail throughout the year, with serendipitous individual face-to-face meetings as travel schedules allow. In its most recent meeting, the Board discussed possible reconfiguration of the Board in tandem with the CNS' evolving needs, particularly the long range development plans for beyond NSF funding horizons.

Center as Infrastructure for Societal Implications Researchers

In its early years CNS-UCSB co-hosted with the NSF two Nano in Society Pls meetings at the NSF in Arlington (2007 and 2008) and processed all funds for the meetings. Subsequently the Center has been involved in development of the new Society for the Study of Nanoscience and Emerging Technologies (S.NET), with PI Harthorn and subaward PI Cyrus Mody playing key roles in development of the Society. For the fall 2010 S.NET conference PI Harthorn submitted a supplement request to NSF for the funds to support participation among researchers from the global south as well as graduate and postdoctoral scholars from the US. This entailed travel and registration assistance and reimbursement processing by CNS staff of all travel expenses for 16 participants at the international meeting, held in Darmstadt, Germany. CNS played a similar role in facilitating crucial participation from developing economies in its Emerging Technologies/Emerging Economies conference in Nov 2009 and in the States of Innovation Workshop held April 2010 in Lyon, France. Thus the infrastructure investment by NSF in the CNS-UCSB is benefiting a wider community of scholars and researchers, and the multi-agency NNI as well. Along with CNS-ASU, CNS-UCSB is taking a leading role in many structured interactions among NSE and societal dimensions researchers (e.g., Nano 2 NNI revisioning meeting Mar 2010), and the Centers are partnering to co-sponsor, co-host the S.NET 2011 conference, to be held in Tempe, Arizona, in Nov 2011. CNS-UCSCB is hosting the website for the conference and the conference program committee, which Director Harthorn co-chairs with CNS-ASU Director Guston.

Management and Operation of Research Program

CNS has established an effective infrastructure for managing the collaborative research efforts of the CNS. CNS' base on a single campus and now conjoint space arrangements simplify these processes.

- Executive Committee meetings on a quasi-monthly basis allow prompt and direct reporting to the group of both administrative and research issues
- Research group meetings take place on a roughly weekly basis at UCSB, often dialing in collaborators for teleconference participation.
- The CNS Graduate Seminar (Soc 591 BH) meets bi-weekly year-round and provides an established forum for sharing of research issues, regular rotating presentations by senior personnel, postdocs, and grads, for discussion and training on research methods, IRB issues, as well as informal interaction. Summer interns are incorporated into the seminar during the 8-week summer internship program.
- Grad Fellows and Graduate Student Researchers work together in common space, which facilitates information sharing across the groups.
- Postdoctoral Fellows work in shared and adjacent space, which also serves to promote interactions; since the move to the new space in Nov 2009, the postdocs have taken the

lead in instituting regular weekly gatherings for tea that include all CNS researchers and staff in informal exchange

- Visiting Scholar/Lecture Series brings together CNS researchers with extramural visitors for formal and informal interactions, sharing; visitors are selected by grads, researchers, and education program
- Research Summit meetings are held in Santa Barbara and allow the free flow of ideas among all CNS collaborators, students, and personnel from the 18 institutions actively involved in core CNS research.
- Management of projects—CNS requires semi-annual reporting and invoicing from all subcontractors, and similar reporting from all IRGs, X-IRG projects and the education program. This permits ongoing formative evaluation by the director and assistant director of progress toward goals, personnel changes on projects at all sites, and outputs.
- IRB—CNS operates under a blanket human subjects protocol in PI Harthorn's name and individual project approvals for all projects involving human subjects, at UCSB and other campuses as appropriate. Assistant Director Gilkes maintains a centralized database to ensure full compliance and to monitor upcoming expirations of existing protocols. PI Harthorn provides annual training on research ethics and individual consultation on specific projects, and Harthorn and Gilkes provide extensive consultation on individual projects as needed.
- Annual process for IRG budget review and allocation—CNS Director Harthorn solicits annual budget proposals from IRGs, allocates funds based on performance, unexpended funds carried forward, and competing needs. Budgets are then discussed in Executive Committee. Budgets are gauged to different research methods and needs.
- New postdocs are required to submit a research proposal to the CNS Exec within a month of their arrival and to provide milestones for assessing progress. Postdoc evaluation takes place on an annual basis in conjunction with university and agency protocols and in compliance with the requirements of the union now in place for UC postdoctoral scholars.
- Funder required annual reporting and site visits provide significant impetus to aggregate and synthesize data within and between research groups
- Annual retreats of the Executive Committee and staff to discuss NSF review results have facilitated group assessment through SWOT analysis and other mechanisms and collective decision making and will be implemented on an as needed basis in the future.

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, and this process is greatly facilitated in our new space. 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. We plan to increase the cyberinfrastructure of the CNS for more effective data sharing and project report generation.

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, the network with other

nanotechnology in society programs, international collaboration, and the clearinghouse. We evaluate work using formative and summative processes at several levels of aggregation: within each working group on a regular, semi-annual basis (some groups do this quarterly), at the executive committee level also on a regular basis, and at the level of the National Advisory Board on an annual or bi-annual basis. Annual reporting on established metrics provides an important set of data on the accomplishments of the CNS and highlights any problematic areas.

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 now standardized 6-month progress reports by the working group project leaders that are available for review by the full CNS executive committee. All subcontractors are required to submit such reports as well. Monthly face-to-face meetings of the Executive Committee have proven invaluable for appraising progress toward goals and identifying areas of concern. 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 periodic updates, meeting bi-weekly with all graduate fellows, and provides extensive programmatic support to undergraduate interns. (See Education section for specific education program evaluation methods, goals, and metrics.)

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 basis. The Director maintains 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, postdocs, 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 Assistant Director and Education Director are involved in the monthly Executive Committee meetings and report to the Director. CNS staff have recourse for advice and assistance to 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). Regular work performance evaluation is mandated for all 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 Assistant Director and Director are in near daily consultation about budget matters, and, as needed, with all personnel, subcontractors, and service providers. CNS accounts were included in a campus audit in 2010 and were found to be entirely satisfactory.

Semi-annual 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 semi-annually 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 meetings with the NAB. Annual reporting is required for all components of the CNS, and such cumulative records are the subject of focused meeting and discussion. The NAB, in addition, meets annually or bi-annually in Santa Barbara and is asked to provide detailed commentary, advice, and criticism both in person and, in some cases, in a written report. In the past a key aspect of the NAB process has been 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. At the most recent meeting (Apr 4 2011) the Board declined to meet without the executive committee and chose instead to have open discussion with us, providing praise for the progress on all fronts and suggestions for long range planning processes.

NSF annual reviews provide an opportunity for summative evaluation. Annual day-long retreats of the CNS Executive Committee and staff have followed the NSF site review process every year since inception in 2006 and will be instituted in the future as needed.

Additional summative measures are drawn at any natural junctures, for example, the completion of a particular research program, or the completion of an iteration of the summer intern program. Entry and exit interviews are conducted with all summer interns and graduate mentors at the start and end of the program, respectively. The annual survey to graduate fellows, both current and past, is conducted in the Fall, after the fellowship year has concluded. More details about these measures are available in the Education section (section 11) of this report.

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—it is a dynamic system that is under study. Uncertainty about both the technical risks and public reception to these emerging technologies complicates this picture. We are tracking changes, in both the nanoscience and the social worlds, and we will address these issues as they emerge. In particular, IRG 3 is tracking social response and participation in a number of ways (media studies, public perception studies). These data do provide empirical data about the changing economic, political and social worlds in which nanotechnologies are unfolding. Significant changes were made in the transition to the renewal award period, most notably the change of IRG configuration from 4 groups to 3 and the launching of a new strategic project program. The annual rotation of (some) grad fellows provides one mechanism to respond to new research opportunities. The addition of subawards provides another. The CNS postdoctoral researcher program also brings in new scholars and new ideas, and CNS is continually expanding its network of collaborators. The National Advisory Board meeting is a particularly important context for discussing, brainstorming, and troubleshooting new ideas and new directions for the CNS.

Table 4a: NSEC Personnel - All, irrespective of Citizenship														
Personnel Type	Total	Gender		Race Data								Ethnicity: Hispanic	Disabled	% NSEC Dollars
		Male	Female	A/AN	NH/PI	B/AA	W	A	More than one race reported, AI/AN, B/AA, NH/PI	More than one race reported, W/A	Not Provided			
Leadership, Administration/Management	15	6	9	0	0	0	12	1	1	1	0	2	0	0%
Subtotal	15	6	9	0	0	0	12	1	1	1	0	2	0	0%
Director(s) ¹	1	0	1	0	0	0	1	0	0	0	0	0	0	100
Thrust Leaders ¹	5	4	1	0	0	0	5	0	0	0	0	0	0	100
Administrative Director and Support Staff	9	2	7	0	0	0	6	1	1	1	0	2	0	78
Research	105	56	49	0	1	3	54	10	4	3	30	8	0	0%
Subtotal	105	56	49	0	1	3	54	10	4	3	30	8	0	0%
Senior Faculty ¹	26	18	8	0	0	0	10	1	0	0	15	1	0	77%
Junior Faculty ¹	14	9	5	0	0	0	6	1	0	2	5	1	0	50%
Research Staff	8	5	3	0	0	0	3	1	0	0	4	0	0	63%
Visiting Faculty ¹	2	0	2	0	0	0	1	1	0	0	0	0	0	100%
Industry Researchers	1	1	0	0	0	0	1	0	0	0	0	0	0	100%
Post Docs ¹	9	5	4	0	0	0	4	1	1	0	3	1	0	100%
Doctoral Students ¹	31	13	18	0	0	2	22	2	1	1	3	2	0	94%
Master's Students ¹	1	0	1	0	0	0	1	0	0	0	0	0	0	0%
Undergraduate Students (non-REU) ¹	13	5	8	0	1	1	6	3	2	0	0	3	0	92%
High School Students	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Curriculum Development and Outreach	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Senior Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Junior Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Research Staff	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Visiting Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Industry Researchers	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Post Docs ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Doctoral Students ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Master's Students ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Undergraduate Students (non-REU) ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
High School Students	0	0	0	0	0	0	0	0	0	0	0	0	0	-
REU Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
REU students participating in NSEC Research ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
NSEC Funded REU Students	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Precollege (K-12)	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Students	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Teachers—RET	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Teachers—Non-RET	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Total¹	120	62	58	0	1	3	66	11	5	4	30	10	0	0%

Table 4b: NSEC Personnel - US Citizens and Permanent Residents														
Personnel Type	Total	Gender		Race Data							Ethnicity: Hispanic	Disabled	% NSEC Dollars	
		Male	Female	A/AN	NH/PI	B/AA	W	A	More than one race reported, AI/AN, B/AA, NH/PI	More than one race reported, W/A				Not Provided
Leadership, Administration/Management														
Subtotal	13	6	7	0	0	0	10	1	1	1	0	2	0	0%
Director(s) ¹	1	0	1	0	0	0	1	0	0	0	0	0	0	100
Thrust Leaders ¹	5	4	1	0	0	0	5	0	0	0	0	0	0	100
Administrative Director and Support Staff	7	2	5	0	0	0	4	1	1	1	0	2	0	86
Research														
Subtotal	90	47	43	1	0	3	49	6	4	3	24	7	0	0%
Senior Faculty ¹	23	16	7	0	0	0	9	1	0	0	13	1	0	74
Junior Faculty ¹	12	8	4	0	0	0	6	1	0	2	3	0	0	50
Research Staff	7	4	3	0	0	0	3	0	0	0	4	0	0	71
Visiting Faculty ¹	1	0	1	0	0	0	1	0	0	0	0	0	0	100
Industry Researchers	1	1	0	0	0	0	1	0	0	0	0	0	0	100
Post Docs ¹	5	1	4	0	0	0	2	1	1	0	1	1	0	100
Doctoral Students ¹	27	12	15	0	0	2	20	0	1	1	3	2	0	97
Master's Students ¹	1	0	1	0	0	0	1	0	0	0	0	0	0	100
Undergraduate Students (non-REU) ¹	13	5	8	1	0	1	6	3	2	0	0	3	0	92
High School Students	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Curriculum Development and Outreach														
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Senior Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Junior Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Research Staff	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Visiting Faculty ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Industry Researchers	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Post Docs ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Doctoral Students ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Master's Students ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
Undergraduate Students (non-REU) ¹	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
High School Students	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Total ¹	103	53	50	1	0	3	59	7	5	4	24	9	0	0%

15. PUBLICATIONS

2010-11

Papers in journals: 10 published; 7 forthcoming; 7 under review

Chapters/sections in books/books: 31 published; 25 forthcoming; 5 under review

Other: 8 published; 1 forthcoming

Total publications: 94

15-A: PAPERS IN JOURNALS

Published

Murr, Meredith M., Stacy E. Patterson, Evelyn L. Hu, Fiona M. Goodchild, & W. Patrick McCray. (2009). From the Ground Up: Developing an Interdisciplinary Course Focusing on Materials Science and Society in Green Technologies. *Journal of Materials Education*, 31(5/6), 251-264. (not previously reported)

Appelbaum, Richard P. (2011). Will China Eat Our Lunch? Review of Denis Fred Simon and Cong Cao, *China's Emerging Technological Edge*. *Asia Policy*(11), 160-164.

Beaudrie, Christian, & Milind Kandlikar. (2011). Horses for Courses: Risk Information and Decision Making in the Regulation of Nanomaterials. *Journal of Nanoparticle Research Special Focus: Governance of Nanobiotechnology* (DOI 10.1007/s11051-011-0234-1), (in press,-advance online).

Mody, Cyrus, & Michael Lynch. (2010). Test Objects and Other Epistemic Things: A History of a Nanoscale Object. *British Journal for the History of Science* 43(3), 423-458.

Mody, Cyrus C.M. (2010). Integrated Circuits: Material, Social, Spatial *Volume*, 24.

Newfield, C. (2010). Review of Steve Shapin, *The scientific life: A moral history of a late modern vocation*. [Book Review]. *Technology and Culture*, 51(4), 1058-1060.

Newfield, Chris. (2010). Science out of the Shadows: Public Nanotechnology and Social Welfare. *Occasion: Interdisciplinary Studies in the Humanities*, 2, 1-19.

Pidgeon, Nick, Barbara Harthorn, & Terre Satterfield. (2010). Nanotech: Good or Bad? *The Chemical Engineer*, 37-39.

Pidgeon, Nick and Baruch Fischhoff "The Role of Social and Decision Sciences in Communicating Uncertain Climate Risks." *Nature Climate Change*, V1(1) Published online March 2011 (DOI 10.1038/NCLIMATE1080).

Scotchmer, Suzanne. 2011. ["Cap-and-Trade, Emissions Taxes, and Innovation."](#) *Innovation Policy and the Economy* 11:1.

Forthcoming

- Appelbaum, Richard, Rachel Parker, & Cong Cao. Developmental State and Innovation: Nanotechnology in China. *Global Networks*, 11(3) (forthcoming July 2011).
- Dillemuth, Julie, Stacey Frederick, Rachel Parker, Richard P. Appelbaum, & Gary Gereffi. Traveling Technologies: Social Implications of Nanotechnology Through the Global Value Chain. *Nano Education* (forthcoming).
- Conti, Joseph A, Theresa Satterfield, & Barbara Harthorn. Vulnerability and Social Justice as Factors in Emergent US Nanotechnology Risk Perceptions. *Risk Analysis* (forthcoming).
- Eisler, Matthew N. Discourses of Revolutionary Applied Science and the Department of Energy. *Science and Public Policy* (forthcoming December 2011).
- Lécuyer, Christophe, & Hyungsub Choi. How Did Semiconductor Firms Manage Technological Uncertainty? *La Revue d'Histoire Moderne et Contemporaine* (forthcoming).
- Motoyama, Yasuyuki, Richard P. Appelbaum, & Rachel Parker. The National Nanotechnology Initiative: Federal Support for Science and Technology, or Hidden Industrial Policy? *Technology in Society* (forthcoming).
- Motoyama, Yasuyuki, & Matthew N. Eisler. Bibliometry and Nanotechnology: A Meta Analysis. *Technological Forecasting and Social Change* (forthcoming).

Under review

- Bimber, Bruce, Meredith Conroy, & Erica Lively. Comparison Effects in Judgment about Public Issues. (Manuscript under review).
- Corner, Adam, Nick Pidgeon, Theresa Satterfield, & Barbara Harthorn. Affective ambivalence and nanotechnologies. *Journal of Risk Research* (under review).
- Eisler, Matthew N. Saving the Phenomenon: Basic Energy Science and the Redemptive Power of Nanotechnology. *Social Studies of Science* (under review).
- Johansson, Mikael. Technological Utopia *Technology, Green Series, 10*. Sage Publications (under review).
- Rogers, Jennifer, Christine Shearer, & Barbara Herr Harthorn. Debating Nano/BioTechnological Alteration of Food: Public Deliberation and Cultural Logics. *Environment and Society* (under review).
- Satterfield, Terre, Joseph A. Conti, Barbara Herr Harthorn, & Nick Pidgeon. Early Warnings Across Malleable Perceptions of Nanotechnologies: Risk, Benefit, Betrayal and Trust. (Manuscript under review).
- Shah, Sonali K., & Cyrus C.M. Mody. Innovation, Social Structure, and the Creation of New Industries. *Academy of Management Journal* (submitted).

15-B: CHAPTERS IN BOOKS AND BOOKS

- Eisler, Matthew N. (2010). Entries. In David H. Guston & J. Geoffrey Golson (Eds.),

- Encyclopedia of Nanoscience and Society* ("Nanotechnology in Manufacturing": 548-551; "Department of Energy (DOE)": 153-154; "Occupational Safety and Health Enforcement": 610-612; "Science Policy": 702-704; "Self-Assembly": 709-710; "Spintronics": 735-736). London: Sage.
- Harthorn, Barbara Herr. (2010). Entries. In David Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanotechnology* ("Gender and Nanotechnology": 269-271; "Amplification of Risk": 669-670; "Attenuation of Risk": 671-672). London: Sage Publications.
- Johansson, Mikael. (2010). Entry. In David H. Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanoscience and Society* ("Nano Culture": 462-463). London: Sage Publications.
- Mody, Cyrus. (2010). Entries. In David H. Guston & J. Geoffrey Golson (Eds.), *Encyclopedia for Nanoscience and Society* ("Chronology of Nanoscience": xxxiii-xliii; "Center for Biological and Environmental Nanotechnology": 76-78; "IBM": 325-328; "Interdisciplinary Research Centers": 348-350; "International Council on Nanotechnology": 351-353; "Microscopy, Atomic Force": 416-417; "Microscopy, Electron (Including TEM and SEM)": 417-419; "Microscopy, Exotic": 419-421; "Microscopy, Optical": 421-422; "Microscopy, Scanning Probe": 423-424; "Microscopy, Scanning Tunneling": 424-425; and "National Institute of Standards and Technology (U.S.)": 580-581). London: Sage Publications.
- Rogers, Jennifer. (2010). Entries. In David Guston & J. Geoffrey Golson (Eds.), *Encyclopedia of Nanotechnology and Society* (pp. "iPod Nano": 363-364; "Friends of the Earth": 261-262; "Center for Nanotechnology in Society-UC Santa Barbara": 80-82.). London: Sage.
- Mowery, David. (2010). Nanotechnology and the U.S. National Innovation System: Continuity and Change. In U. Fiedeler, C. Coenen, S.R. Davies & A. Ferrari (Eds.), *Understanding Nanotechnology* (pp. 85-100). IOS Press.
- Harthorn, Barbara Herr. (2011). Methodological Challenges Posed by Emergent Nanotechnologies and Cultural Values. In Sharlene Nagy Hesse-Biber (Ed.), *The Handbook of Emergent Technologies and Social Research* (pp. 65-88). Oxford: Oxford University Press.
- Appelbaum, Richard P., Rachel Parker, Cong Cao, & Gary Gereffi. (2011). China's (Not So Hidden) Developmental State: Becoming a Leading Nanotechnology Innovator in the Twenty-first Century. In Fred Block & Matthew R. Keller (Eds.), *State of Innovation: The U.S. Government's Role in Technology Development* (pp. 217-235). Boulder, CO: Paradigm Press.
- Newfield, Chris. (2010). Avoiding Network Failure: The Case of the National Nanotechnology Initiative. In Fred Block & Matt Keller (Eds.), *State of Innovation: The U.S. Government's Role in Technology Development*. Boulder, CO: Paradigm Press.
- Newfield, Chris. (2010). Is the Corporation a Social Partner? The Case of Nanotechnology. In Purnima Bose & Laura E. Lyons (Eds.), *Cultural critique and the global corporation* (pp. 215-224). Bloomington, IN: Indiana University Press

Roco, Mihail, Barbara Herr Harthorn, David Guston, & Philip Shapira. (2010). Innovative and Responsible Governance of Nanotechnology for Societal Development. Ch. 13 in M. Roco (Ed.), *Nanotechnology Research Directions for Societal Needs in 2020*. Boston and Berlin: Springer.

Forthcoming

Appelbaum, Richard, & Rachel Parker (Eds.) *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Routledge (forthcoming 2012).

Harthorn, Barbara Herr, & John W. Mohr (Eds.). *The Social Life of Nanotechnology*, Routledge (forthcoming 2011/2012).

Beaudrie, C.E.H., M. Kandlikar, & G. Ramachandran. Using Expert Judgment for Risk Assessment. In G Ramachandran (Ed.), *Assessing Nanoparticle Risks to Human Health*. Elsevier (IN PRESS)
<http://www.springerlink.com/content/k45528766006522v>.

Eisler, Matthew N. *Overpotential: Fuel Cells, Futurism, and the Making of a Power Panacea* Piscataway, NJ: Rutgers University Press (forthcoming 2011).

Eisler, Matthew N. Where Nano Came From. In Susanna Priest (Ed.), *Nanotechnology and the Public Sphere: Risk Perception, in Risk Communication, and Public Engagement* (forthcoming).

Harthorn, Barbara, Jennifer Rogers, Christine Shearer, & Tyronne Martin. Debating Nanoethics: U.S. Public Perceptions of Nanotechnology Applications for Energy and the Environment. In Dane Scott & Blake Francis (Eds.), *Debating Science: Deliberation, Values, and the Common Good* (2nd ed.). Prometheus Books (forthcoming).

McCray, W. Patrick. California Dreamin': Visioneering the Technological Future. In Volker Janssen (Ed.), *Minds and Matters: Technology in California and the West*. University of California Press (forthcoming).

McCray, W. Patrick. From L-5 to X-Prize. In Peter J. Westwick & William Deverell (Eds.), *Blue Sky Metropolis: Aerospace and Southern California*. University of California Press (forthcoming).

Appelbaum, Richard, & Rachel Parker. The Promise and Perils of High-Tech Approaches to Development, introductory chapter. In Rachel Parker & Richard Appelbaum (Eds.), *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Routledge (forthcoming 2012).

Parker, Rachel, & Richard P. Appelbaum. Emerging Technologies/Emerging Economies: Nanotechnology for Equitable Development, *ch.10*. In Rachel Parker & Richard P. Appelbaum (Eds.), *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* Routledge (forthcoming 2012).

Harthorn, Barbara, Christine Shearer, & Jennifer Rogers. Constraints on Benefit of New Technologies for the World's Poor: A View from the North on Fairness. In Rachel

- Parker & Richard Appelbaum (Eds.), *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* : Routledge (forthcoming).
- Rogers, Jennifer, & Amy Zader. Food Security: From the Green Revolution to Nanotechnology. In Rachel Parker & Richard Appelbaum (Eds.), *Emerging Economies, Emerging Technologies: Can Technology Make a Difference in Development?* : Routledge (forthcoming).
- Appelbaum, Richard, & Cong Cao. The Chinese Century? Some Implications of China's Move to High-Tech Innovation for U.S. Policy. In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*. Routledge (forthcoming 2011/2012).
- Corner, Adam & Nick Pidgeon. "Nanotechnologies and Upstream Public Engagement: Dilemmas, Debates and Prospects?" Forthcoming in *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge, (forthcoming 2011/2012).
- Eisler, Matthew N. You Say you Want a Revolution: Nanotechnology and Continuity and Change in U.S. R&D Policy In Barbara Herr Harthorn & John Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (forthcoming 2011/2012).
- Freudenburg, William and Mary Collins. Recreancy and Nanotechnology: A Call for Empirical Research, In Barbara Herr Harthorn and John Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge, (forthcoming 2011/2012).
- Haldane, Hillary, Karl Bryant, & Barbara Herr Harthorn. Expertise and Expectations: The Role of Gender in Expert Perceptions of Emergent Nanotechnologies. In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (forthcoming 2011/2012).
- Harthorn, Barbara Herr & John Mohr. "Introduction: The social scientific view of nanotechnologies." Forthcoming in *The Social Life of Nanotechnology*, Eds. Barbara Herr Harthorn and John Mohr, Routledge (forthcoming 2011/2012).
- Johansson, Mikael. Working for Next to Nothing - Labor in the Global Nanoscientific Community. In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*, Routledge (forthcoming 2011/2012).
- Lively, Erica, Meredith Conroy, David Weaver & Bruce Bimber. "News media frame novel technologies in a familiar way: Nanotechnology, applications and progress." In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*. New York: Routledge (forthcoming 2011/2012).
- McCray, W. Patrick. When Space Travel and Nanotechnology Met at the Fountains of Paradise. In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (forthcoming).
- Mody, Cyrus C.M. Conferences and the Emergence of Nanoscience. In Barbara Herr Harthorn & John Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (forthcoming).

- Parker, Rachel, Richard Appelbaum, & Yasuyuki Motoyama. Industrial Policy and Nanotechnology Development: Does Public Investment Pay off? . In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (forthcoming).
- Rogers, Jennifer, Christine Shearer, & Barbara Herr Harthorn. Situating Nano in the Social World. In Barbara Herr Harthorn & John W. Mohr (Eds.), *The Social Life of Nanotechnology*: Routledge (expected 2011).
- Mody, Cyrus C.M. *Instrumental Community: Probe Microscopy and the Path to Nanotechnology* Cambridge, MA: MIT Press (forthcoming).

Under review

- Harthorn, Barbara, Christine Shearer, & Jennifer Rogers. Exploring Ambivalence: Techno-Enthusiasm and Skepticism in US Nanotech Deliberations. In Torben Zuelsdorf (Ed.), *Society for the Study of Nanoscience and Emerging Technologies* (under review).
- Johansson, Mikael. Vi är dina provexemplar”– om etnografiskt fältarbete i laboratoriemiljö. In Jan Bärmark (Ed.), *Att tänka genom kulturer*. Carlssons forlag (under review).
- Mody, Cyrus. Climbing the Hill: Seeing (and Not Seeing) Epochal Breaks from Multiple Vantage Points In Alfred Nordmann, Hans Radder & Gregor Schiemann (Eds.), *Science and Its Recent History: Epochal Break or Business as Usual?* Pittsburgh: University of Pittsburgh Press (submitted).
- Mody, Cyrus. Conversations: Sounds and Sight, Military and Civilian In Trevor Pinch & Karin Bijsterveld (Eds.), *Sound Studies Handbook: New Directions*. Oxford: Oxford University Press (submitted).
- Mody, Cyrus C.M. Essential Tensions and Representational Strategies. In Michael Lynch, Steve Woolgar, Janet Vertesi & Catelijne Coopmans (Eds.), *Representation in Scientific Practice II*. Cambridge, Mass: MIT Press (volume submitted).

15-C: Other: reports, commentary, opinion pieces, oral histories, dissertations

- Harthorn, Barbara Herr. (2010). Public participation in nanotechnology – should we care? *2020 Science*. May 4, 2010, available on-line at:
<http://2020science.org/2010/05/04/public-participation-in-nanotechnology-should-we-care/>
- Beaudrie, Christian. (2010). Emerging Nanotechnologies and Life Cycle Regulation: An Investigation of Federal Regulatory Oversight from Nanomaterial Production to End of Life. *Chemical Heritage Foundation*, 1-63.
- McCray, W. Patrick. (2010). Re-Thinking Innovation: A New Agenda for Academic Investigation. *Science Progress*, May 2010, available on-line at:
<http://www.scienceprogress.org/2010/05/re-thinking-innovation/>

- McCray, W. Patrick. (2010). Unintended Consequences: What Ten Years of the National Nanotechnology Initiative Can Teach Us About Federal R&D. *Science Progress*, March 2010, , available on-line at: <http://www.scienceprogress.org/2010/03/unintended-consequences/>
- Mody, Cyrus. (2010). Institutions as Stepping-Stones: Rick Smalley and the Commercialization of Nanotubes *Studies in Materials Innovation, Chemical Heritage Foundation*, 1-26.
- Applebaum, Richard P., Bruce Bimber, and Barbara Herr Harthorn. (2010). NSF SBE 2020 White paper. Published on-line at http://www.nsf.gov/sbe/sbe_2020/all.cfm
- Parker, Rachel. 2010. "Science, Technology, and Innovation Policy: High-tech Industry Growth in China," Doctoral dissertation, Department of Sociology, University of California, Santa Barbara, July 2010.
- Conroy, Meredith. 2010. "A Psychology of Framing: The Effects of Personality on Susceptibility to Media Frames," Doctoral dissertation , Department of Political Science, University of California at Santa Barbara, December 2011.

Forthcoming

- Eisler, Matthew N. Shifting Molecules, Mixing Metaphors: A Short History of Science, Technology, and Energy. *Science Progress* (forthcoming).

16. BIOGRAPHICAL INFORMATION, No New Senior Personnel

17. HONORS AND AWARDS

2010

Mehta, Aashish. Faculty Career Development Award, March 28, 2010.

Appelbaum, Richard. MacArthur Foundation Chair in Global & International Studies and Sociology. April 2010 (for 5 years).

Conti, Joseph. Lancaster Dissertation Award in the social sciences. May 2010.

Goodchild, Michael. Elected to the British Royal Society. May 2010.

Hawker, Craig. Fellow of the British Royal Society. May 2010.

Engeman, Cassandra. Dissertation research grant from the Flacks Fund for the Study of Democratic Possibilities. June 2010.

Shearer, Christine. Dissertation book contract. June 2010 (expected publication 2011).

Rogers, Jennifer. UC Mexus postdoctoral fellowship. June 2010. (Declined, to accept faculty position at Long Island University.)

Mehta, Aashish. Hellman Family Faculty Fellowship, in July 2010, effective 2010-11 academic year.

Shearer, Christine. "Best Student Paper" award from the Natural Resources Research Group. August 2010.

Hawker, Craig. American Chemical Society Arthur C. Cope Scholar Award. September 2010.

Jackson, Simone. Invited to present Undergraduate Research results at SACNAS conference in Anaheim, CA. September 2010.

Parker, Rachel. Selected Research Staff Member, Science and Technology Policy Institute, Washington, D.C. September 2010.

Goodchild, Michael. National Science Foundation's (NSF) Distinguished Lecture series. November 2010.

Rajan, Sriyay. Invited to present Undergraduate Research results at Sigma Xi conference in Washington, DC. November 2010.

Friedman, Sharon. Fellow of the Society of Risk Analysis. December 2010.

Denes, Amanda. Graduate Collaborative Research Grant, Interdisciplinary Humanities Center at the University of California, Santa Barbara, for collaborative project among doctoral students from Communication, Theater and Dance Studies, and Feminist Studies. 2010.

Denes, Amanda. Top Paper Award, Family Communication Division, National Communication Association (NCA). 2010.

Denes, Amanda. Top Student Paper Award, Interpersonal Communication Division, International Communication Association (ICA). 2010.

Mody, Cyrus C.M., Mara Mills, and Patrick McCray. ACLS Collaborative Research Fellowship for *Micro-Histories and Nano-Futures: The Co-Production of Miniaturization and Futurism*. 2010.

2011

Appelbaum, Richard. Elected as a Fellow of the American Association for the Advancement of the Sciences (AAAS). January 2011.

Bimber, Bruce. Elected as a Fellow of the American Association for the Advancement of the Sciences (AAAS). January 2011.

D'Arcangelis, Gwen. Recognized by *INSPIRATIONS: Honoring New Women, Appointed Post Docs and Recently Tenured Women at UCSB*. January 2011

McCray, Patrick. Awarded the 2011-12 Searle Visiting Professorship at Cal Tech and the Huntington Library. Announced January 2011.

Santos, Nicholas. Invited to present Undergraduate Research results to the Association of American Geographers in Seattle, WA. Invited Jan 2011, conference in April 2011.

Denes, Amanda. Top Student Paper Award, Interpersonal Communication Division, International Communication Association (ICA). 2011.

Denes, Amanda. Top Student Paper Award, Organization for Research on Women and Communication, Western States Communication Association (WSCA). 2011.

Denes, Amanda. Research Grant, Santa Barbara Pro-Choice Coalition. 2011.

Mody, Cyrus. NSF Scholars Award for *The Long Arm of Moore's Law: New Institutions for Microelectronics Research, 1966-2004*. Award date 2011-12.

Newfield, Chris. Appointed as Fellow at the Centre for Research in the Arts, Social Sciences and Humanities at Cambridge University (UK). 2011.

Table 6: Partnering Institutions

Institution Type	Name of Institution	Receives Financial Support From Center	Contributes Financial Support To Center	Minority Serving Institution Partner	Female Serving Institution Partner	National Lab/ Other Govt. Partner	Industry Partner	Museum Partner	International Partner
I. Academic Partnering Institution(s)	Allan Hancock			Y					
	Arizona State University								
	Australian National University								Y
	Beijing Institute of Technology	Y							Y
	Cal Poly San Luis Obispo								
	Cardiff University, Wales, UK	Y							Y
	CNRS - France								Y
	Cornell University							Y	
	Cuesta Community College								
	Duke University	Y							
	Ecole Polytechnique, Paris								Y
	Harvard University		Y						
	Howard University			Y					
	Jackson State University			Y					
	Lehigh University	Y							
	Long Island University								
	Massachusetts Institute of Technology								
	Michigan State University								
	Moorpark College								
	Natl Academy of Agricultural Research Management, India								Y
	New York University								
	Northeastern University								
	University Nottingham, UK								Y
	Occidental College								
	Oxnard Community College			Y					
	Quinnipiac University								
	Rice University	Y	Y						
	Santa Barbara City College								
	Southeastern Louisiana University			Y					
	SUNY Levin Institute								
	SUNY New Paltz	Y							
	University Sussex								Y
	Universidad Autónoma de Zacatecas, Mexico								Y
	Université de Lyon 2								Y
	Université de Lyon 3		Y						Y
	University of British Columbia, Vancouver, Canada	Y							Y
	University of California, Berkeley	Y							
	University of California, Davis	Y							
	University of California, Los Angeles		Y						
	University of California, Santa Cruz	Y							
	University of East Anglia, Norwich, UK								Y
	University of Edinburgh, Scotland, UK								Y
	University of Pennsylvania								
	University of South Carolina								
	University of South Florida								
	University of Washington	Y							
	University of Wisconsin-Madison	Y							
	Venice International University								Y
	Ventura College								
Total Number of Academic Partners	49	11	3	4	0	0	0	1	14

Table 6: Partnering Institutions									
Institution Type	Name of Institution	Receives Financial Support From Center	Contributes Financial Support To Center	Minority Serving Institution Partner	Female Serving Institution Partner	National Lab/ Other Govt. Partner	Industry Partner	Museum Partner	International Partner
II. Non-academic Partnering Institution(s)	American Bar Foundation								
	American Institute of Physics Incorporated								
	Boudreaux and Associates	Y					Y		
	Chemical Heritage Foundation	Y					Y		
	Cynthia Cannady, Legal Services	Y							
	Decision Research	Y							
	Environmental Defense Fund								
	International Council on Nanotechnology (ICON), Rice University								
	International Risk Governance Council, Switzerland								Y
	Knowledge Networks	Y							
	Meridian Institute	Y							
	Nanoholdings, LLC (NY)								
	Nanoscale Informal Science Education (NISE) network							Y	
	Northwest Survey and Data Services	Y							
	Santa Barbara Museum of Natural History							Y	
	Woodrow Wilson International Center	Y	Y						
	Total Number of Non-academic Partners	16	8	1	0	0	0	2	2