

US Presidential Commission on Bioethics
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Washington DC
Comments from Dr. Barbara Herr Harthorn, UC Santa Barbara

Thank you for this opportunity to speak about "how the National Nanotechnology Initiative (NNI) employs advisory committees to inform ethics integration into nanotechnology research and development."

I will respond in 3 parts: 1) how advisory committees are structured; 2) how they "inform ethics integration into nano R&D"; and 3) other processes by which knowledge about social and ethical issues is being incorporated into the nanotech R&D enterprise. The NNI has had many successes and, as an early effort at integrating research on science and society at this scale, provides lessons that could enable us to do even better at achieving the BRAIN Initiative's goal of "maintaining our highest ethical standards"¹.

1) Advisory Committees. The NNI is a sprawling interagency initiative with primary funding flowing directly to its many participating agencies. The 2 main advisory committees established for the NNI are **PCAST** (President's Council of Advisors on Science & Technology), which has served since 2004 as the *National Nanotech Advisory Panel* (per the authorization bill);² and the **National Academies of Science/NRC**, which since 2002 has provided a series of independent reviews^{3,4}.

Reviews by both advisory groups have been conducted primarily as closed-door sessions where the committees gather information and invited expert testimony from many sectors, which is then synthesized into reports. As a societal issues center director, I have provided oral and extensive written testimony for both PCAST and the NAS; PCAST has also incorporated our research results. Both committees are composed primarily of S&E and, for PCAST, industry representatives, so societal/ethics issues are not a priority⁵. Both PCAST and NRC reports have included praise for accomplishments and, particularly in the case of NRC reports, highlighted areas of concern, including those impinging on ethics and responsible development.

Societal and ethical implications and public participation were firmly stipulated in the NNI authorization bill (2003)⁶ and within a number of inter- and intra-agency initiatives⁷. NNCO has taken the lead in conjunction with NSET and its working groups in organizing stakeholder workshops⁸ and NSF has organized events like the Nano2 conference (2010) to assess progress toward goals including societal implications.⁹

The 2006 NRC report described nanotechnology as a "potentially disruptive emerging technology" that would require a different approach to handling risks, benefits and uncertainty. Responsible development of nanotechnology, they stated, requires "collaborations between chemists and toxicologists, as well as social scientists who desire to address the ethical and policy issues related to use of nanotechnology." This new approach entails "taking an integrated approach to ethical issues that will also involve the public in thinking through the implications of nanotechnology." The report asserted the value of "informed outside review and societal participation in decision making about the introduction of significant new

technologies into our environment” (NRC 2006:88). PCAST’s 2010 report lauded “NNI’s strong and growing portfolio of research on the societal implications of nanotechnology, nanotechnology education, and public outreach.”¹⁰

2) Integration. The NNI, and particularly NSF, has been unprecedentedly forward looking in its attention to upstream societal/ethics concerns. In 2003, the NSF funded a series of societal research and education projects and in 2005 awarded 2 national centers at UC Santa Barbara and Arizona State University to address societal/ethical issues. Though modest in funding by S&E Center standards,¹¹ they jointly represent the largest such investment in the world. Now in their 9th of 10 years of funding, these centers and related societal research have produced an international network of scholars¹² and a robust body of scholarly and policy-relevant research that touches on many of the issues discussed here.

Our Center at UCSB has produced a range of published work on modes of incorporating diverse voices into public deliberation, multiple party risk and benefit perceptions, worker safety, social, political and economic analyses of the global nano innovation system, particularly in China and the US, and comparative historical analyses of other emerging technologies. Both Centers have developed pioneering research and education programs for integrating responsible development research with our nanoscience colleagues, and both are co-generating knowledge and engaging with a range of stakeholders.

In spite of this output and the production of a rising generation of responsible development scholars (e.g., Erik Fisher), I believe that the integration of societal/ethics research into the NNI has primarily taken place through individual, informal and bottom up channels rather than top down structures or formal processes for incorporation. I provide below examples of the ways we (and others across these many agencies, committees and networks) have sought to integrate societal ethics research with nanotech R&D in the absence of formal mechanisms.

Safety is one place where the integration of advisory concerns about potential hazards of engineered nanomaterials has produced extensive research. Environmental health and safety have been flagged as a critical area of interagency (and international) coordination, with noticeable effects. For example, 2 large ecotoxicology centers at UCLA and Duke were jointly funded in 2008 by NSF and EPA. Though primarily focused on technical hazards of ENMs in the environment, they include societal issues. For example, I lead a team of societal researchers in the UCLA CEIN working to integrate public and expert risk perception research findings with the scientific risk assessment enterprise. This has involved extensive social science/nanoscience collaboration over the past 5 years, including the co-production of 2 international surveys of nanomaterials companies’ workplace safety practices¹³ and my ongoing work on the Center’s Executive Committee. Note: Center structures are particularly conducive to such integration.

3) Integrating Science and Society. The prominence of research on societal implications of nanoscale technologies has already peaked in priority in the NNI in the absence of emergent controversy. Nano social science researchers have engaged the S&E community, toxicologists, policymakers, industry partners, NGOs and diverse publics¹⁴ on issues of risk and benefit, governance, innovation, and the future. A very partial list of such activities includes:

- Organizing societal components in regional/national & international workshops, conferences and meetings about global nano R&D.
- Reporting on public deliberations on imagined nano futures, hopes and concerns¹⁵
- Providing empirical evidence about public risk perceptions for risk management and communication efforts
- Sharing science and society news via blogs, news clippings, clearinghouses, and science cafes, museum nano days, NGO conferences, etc.
- Collaborating as full partners on research, education and outreach initiatives w/ NSE colleagues
- Training a new generation of scientists and engineers who think beyond the bench by embedding NSE-in-training in our social science enterprise.

The societal/ethics component of the NNI is relatively small and just now reaching maturity. The BRAIN Initiative launch 10 months ago conveyed a strong desire to capture the public's imagination about the possibilities for S&T development to solve critical medical problems and to advance understanding in vital new directions; it acknowledges the critical anticipated role of ethical, responsible development to achieve this goal. Determining the nature and extent of societal concerns that need to be addressed by the BRAIN Initiative in a systematic, ethical, and scientifically valid way will require significant investment in social and behavioral research **and** in the infrastructure for its coordination and dissemination.

Endnotes:

¹ Fact Sheet: BRAIN Initiative | The White House.pdf Apr 02, 2013; downloaded on 2/6/14 from <http://www.whitehouse.gov/the-press-office/2013/04/02/fact-sheet-brain-initiative>

² PCAST has generated 4 assessments to date, beginning in 2005. The NRC provided an initial review in 2002, and then made 3 'triennial' reviews, and a review of Nano-related EHS Research (2009).

³ Via the Committee to Review the NNI/Committee on Triennial Review of the NNI

⁴ The coordination of this complex initiative takes place through the NSET (Nanoscale Science, Eng & Tech) subcommittee of the NSTC and NNCO.

⁵ Social science other than economics not permitted in the case of the NRC.

⁶ 21st Century National Nanotechnology Research and Development Act, 2003

⁷ E.g., the NSF's Societal Implications program and network, the NEHI and NPEC Working Groups of the NSET; NIOSH; etc.

⁸ E.g. NNCO & NPEC-2006 Public Participation (2012 report); NNCO - 2007 Ethics workshop at ASU--NNCO & NEHI; 2010 Risk capstone--NNCO; NEHI; NEHI and NIOSH-2010 Keystone Medical surveillance conf; 2013 June NNI stakeholders meeting--NNCO/NSET; NNCO/NSET 2013 Risk stakeholder meeting; numerous EH&S conferences; etc.

⁹ Roco, Harthorn, Guston & Shapira. 2011. *Journal of Nanoparticle Research*.

¹⁰ <http://www.whitehouse.gov/blog/2012/04/27/pcast-releases-assessment-national-nanotechnology-initiative>

¹¹ The two CNSs together receive approximately the same funding as 1 S&T NSEC, or just under \$13M over 5 yrs.

¹² The Society for the Study of Nanoscience and Emerging Technologies (the S.NET), <http://www.thesnet.net/>

¹³ Conti et al. 2008 *ES&T*; Engeman et al. 2012 *JNR*; Engeman et al. 2013 *JOEH*.

¹⁴ E.g., panels at AAAS; webinars to NACK center; presentations on industry self reported safety practices to industry consortia; organizing and presenting in SNO; Data for Policymakers for the Congressional Nanotech Caucus, etc.

¹⁵ Pidgeon et al. 2009 *Nature Nanotechnology* re: CNS-UCSB US-UK comparative public deliberations