

it encourages development of pernicious technologies and inventions, even those likely to cause substantial harm to people and the environment. Second, it allows private ownership of basic resources that should belong to everyone. The activities in this field clearly target mainly the United States, but since the United States encourages other governments to adopt these policies and make them the global norm, international implications cannot be denied.

Concerning nanotechnological applications beyond research, ICTA opts for a more thorough and profound evaluation of products containing nanoparticles, and seeks to shift the burden of proof onto the producers by halting commercialization of products containing nanoparticles until they have been proven safe. ICTA seeks to force federal regulatory agencies to adopt an accurate and standardized definition of nanotechnology, and to regulate emerging nanotechnologies as they would other materials whose safety has not been determined. NanoAction is a nanotechnology-focused advocacy project of the ICTA.

Recent advocacy campaigns organized by the ICTA include two calls for further regulation of nanotechnology by the U.S. Environmental Protection Agency. The first study, conducted in conjunction with the Center for Food Safety, concerns nanoparticle silver, which is used in many consumer products (often advertised using claims of its germ-killing ability). It is not yet known if nanosilver threatens human and aquatic health, and its germicidal properties are debatable. The second study called for the National Organic Standards Board of the U.S. Department of Agriculture to prohibit the use of nanotechnology in organic products.

In their efforts targeting developments in human biotechnology, ICTA seeks to keep policy makers, activists, and the public informed about developments in human biotechnology. ICTA also encourages a strong regulatory framework to ensure that human genetics research proceeds only under strict ethical standards. The center's main actions in this field are set against all kinds of cloning, be it animal cloning or techniques that might enable cloning of humans.

ICTA is also a founding member of the Center for Corporate Policy, an organization that advocates in the field of corporate responsibility and accountability.

**See Also:** Anticipatory Governance; Codes of Conduct, Corporate; Federal Institute for Risk Assessment (Germany);

Food; Genetically Modified Food; Governance; Nanoparticle Occupational Safety and Health Consortium; Nanosilver; NanoTrust Project (Austria); Nanotechnology Safety for Success Dialogue (Food Industry); National Industrial Chemicals Notification and Assessment Scheme (Australia); Research and Innovation Assessment; Risk Assessment; Risk Governance; Technology Assessment.

### Further Readings

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## International Council on Nanotechnology

Justifications for nanotechnology research are often predicated on the importance of different kinds of diversity: diversity of disciplines contributing to the field; diversity of nations competing and cooperating in the commercialization of nanoscience; and diversity of stakeholders (i.e., corporate, academic, government, nongovernmental organizations, and the media). Diversity usually requires institutions to confer coherence, however—otherwise, participants are likely to fracture into their respective constituencies. Disciplinary diversity in nanotechnology has largely been fostered by government-funded academic interdisciplinary research centers, for which there is a long history of institutional models. International and stakeholder diversity, however, has required new kinds of institutions. One of the first and most important of these has been the International Council on Nanotechnology, a semiautonomous spin-off of the Center for Biological and Environmental Nanotechnology at Rice University.

### Meeting the Public Halfway

In the first wave of National Science Foundation–funded Nanoscale Science and Engineering Centers, the Center for Biological and Environmental Nanotechnology (CBEN) at Rice University was the one most oriented to interaction with the wider public. CBEN was designed to maximize nanotechnology's positive impact on health and the environment partly through sustained, honest research on its potential risks. Communicating those risks to the wider public and to policy makers was intended to head off any backlash against overhyped claims for nano, and to foster responsible, transparent commercialization of nanoresearch.

As Chris Kelty, an anthropologist working with CBEN, puts it, though, “the public’ as such has no secretary to call, and no e-mail address.” Thus, if CBEN wanted to disseminate its findings to the public, it would, in some sense, need to constitute that public itself. To do so, in 2005 it spun off the International Council on Nanotechnology (ICON), headed by CBEN’s executive director, Kristen Kulinowski. ICON was built largely from a small industrial affiliates program that Kulinowski had already been operating for several years. This, in turn, shaped the flavor of ICON’s early work. The largest company in the affiliates program, DuPont, had wanted to stimulate social science research on, for example, media coverage and public perception of nanotechnology. Thus, in transforming the affiliates program into ICON, social scientists, such as Kelty and Steve Currall at Rice and David Berube from the University of South Carolina, were included from the beginning.

### Host, Honest Broker, Central Player

Over time, ICON evolved away from simply funding social science research and toward community building and dialogue among different types of stakeholders. Its early aim was to take the “social and ethical issues” rhetoric espoused at the National Nanotechnology Initiative and NSF and turn it into something concrete. In this role, ICON would have simply been an adjunct to the science going on in CBEN. However, it soon became clear to Kulinowski and Vicki Colvin, CBEN’s director, that “social and ethical issues” encompassed something much wider than the biological and environmental scope of CBEN itself.

This realization stimulated a subtle but important restructuring. Kulinowski decided that ICON would not try to enact all the social and ethical issues of nanotech-

nology; instead, it would focus exclusively on the environmental health and safety dimensions of those issues, and serve as a neutral, honest broker for information, and a host convening various stakeholders. This would require ICON to be more autonomous from CBEN; at the same time, CBEN researchers would need to suffuse their own work with a “social and ethical issues” perspective, instead of simply outsourcing that work to ICON. For a time, ICON was perhaps the only organization trying to play this role, so it was able to attract a diverse array of member organizations. These included small start-ups eager for health and safety information about nanoparticles (both to be ready for potential public perception issues but also to safeguard their own employees)—such as Carbon Nanotechnologies, Inc. (now Unidym), a Houston start-up associated with Rick Smalley’s laboratory at Rice. Large companies that had had brushes with the backlash against genetically modified organisms, such as DuPont and the insurance giant Swiss Re, also signed up. Government agencies such as EPA—at the state and federal level in the United States, and national bodies from countries such as Canada—saw ICON as a way to keep abreast of a fast-moving field as well as to receive input from constituents. Standards-setting bodies such as the International Standards Organization and ASTM International saw ICON as a potential clearinghouse for best practices for handling nanomaterials. And nongovernmental organizations (NGOs), such as Consumers Union, affiliated with ICON in order to have a seat at the policy table. To handle the diverse interests of its members, ICON divided into four working groups: governance, knowledge base, best practices, and communications. This division acknowledges that very little is known about how one would go about determining the health and safety impacts of engineered nanomaterials; even less is known about those impacts themselves; and what little knowledge exists is often “known” only to small groups of practitioners, rather than to the wider community of relevant stakeholders.

Thus, one of ICON’s first and biggest tasks was to organize “Research Needs Assessment” workshops in January and June 2007, in which stakeholders representing a variety of organizations and disciplines would map out what needed to be learned about nanotoxicology, across several different classes of nanomaterials. In parallel, ICON commissioned a study by the Center for Nanotechnology in Society at the University of California, Santa Barbara (CNS-UCSB) to find out exactly how

nanomaterials-producing organizations (both companies and research labs) were dealing with health and safety issues. One important finding from this research was that perception matters—organizations that dismissed the potential risks of nanomaterials had fewer risk mitigation procedures than organizations that believed such risks could exist.

### A Surfeit of Success

As the field of nanotoxicology has come into being, and greater information about health and safety issues has emerged (along with greater demand for that information), ICON has shifted more to an information dissemination role. This is managed through a variety of mechanisms—reports and backgrounders for policy makers and stakeholders who are unfamiliar with the issues; a virtual journal collating articles on nano environmental health and safety; and a “GoodNanoGuide” wiki to allow the diverse array of stakeholders and expertise to collectively establish best practices for handling of nanomaterials.

Through these various outlets, ICON has maintained a substantial presence in public debates about nanotechnology. Yet, its success has in some ways threatened its own role. Though ICON is still perhaps the only organization that integrates all of the functions covered by its four working groups, other organizations have emerged that have more resources or relevant expertise to better handle a narrower slice of ICON’s responsibilities. For instance, the Woodrow Wilson International Center’s Project on Emerging Nanotechnologies has the access to policy makers and the media to carry out some of ICON’s governance functions more easily. The two Centers for Nanotechnology in Society, at UCSB and Arizona State University, have taken on many of the social science research roles that were ICON’s original inspiration. And as nanotoxicology becomes a more established subdiscipline, it will no doubt evolve many of the disciplinary institutions—professional societies, annual conferences, journals—that ICON has supported.

ICON began with few clear institutional models, yet it now serves as a model for a wide variety of institutions that may prove to be longer lasting than ICON itself. At this date, it is unclear what will become of ICON. It is clear, however, that the Council has established a vocabulary for talking about environmental health and safety issues in nanotechnology that did not exist before, as well as mechanisms whereby that vocabulary can be shared.

**See Also:** Center for Biological and Environmental Nanotechnology; Center for Nanotechnology in Society (ASU); Center for Nanotechnology in Society (UCSB); Nanotoxicology; Woodrow Wilson International Center.

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## International Development

Nanotechnology, particularly the increase in nanotechnology research and development (R&D) occurring in developing countries, has reinvigorated debates about the relationship between science and technology and international development. Significant debates about nanotechnology and development first emerged in policy, academic and nongovernmental communities around 2000. Largely, the debates have been polarized and echo those about previous emerging technologies, such as biotechnology. In the more prominent view, nanotechnology is touted as a global transformative technology that will be an instrument of economic growth and create an array of social benefits for those living in developing countries. Critics taking the opposing view argue that nanotechnology will be detrimental to developing countries because of social, economic, and legal considerations such as: intellectual property, how nanotechnology could affect the demand for commodities, and the complexities of technology transfer. These factors could mean that nanotechnology will be more likely to benefit affluent societies, will make developing countries more dependent on developed countries and will create greater inequalities between and within nations.