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Nanotechnology under the microscope



Christopher Bosso is the director and principal investigator for Northeastern's Nanotechnology and Society Research Group. Photo by Lauren McFalls

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Nanotechnology is a continually developing branch of science, one with political, environmental and ethical implications that are not yet fully understood. Among those taking the lead to clarify those issues is Christopher J. Bosso, associate dean of **Northeastern's School of Public Policy and Urban Affairs** and director and principal investigator for the University's **Nanotechnology and Society Research Group**. Bosso is also author of a new book "Governing Uncertainty: Environmental Regulation in the Age of Nanotechnology." Here, he discusses public policy related to nanotechnology and the potential impact of the fast-growing science, for good and ill.

Can you explain how you became involved in thinking about nanotechnology?

Every new technology has direct and indirect consequences for human health, the natural environment and the society at large. I have had a long interest in the public policy dimensions of such consequences going back to my doctoral work on chemical pesticides. So it did not take much convincing when faculty colleagues Jackie Isaacs (mechanical and industrial engineering), Ron Sandler (philosophy and religion) and Woody Kay (political science) asked me to join them in ongoing policy and ethics work connected to Northeastern's Center for High-rate Nanomanufacturing (CHN).

We quickly realized that we were confronting a set of issues beyond CHN's immediate domain, so with CHN director Ahmed Busnaina's help, we put together our own National Science Foundation proposal to look at the broader environmental and health challenges posed by nanomaterials. We had the right proposal at the right time, giving us a rare opportunity to do organized and sustained interdisciplinary thinking about policy and ethical issues related to nanotechnology and other emerging technologies.

Is it common for a university with so much science and engineering research in nanotechnology to also study its possible societal impacts? What are the benefits?

It is not uncommon. The difference lays in organization, breadth and sustained effort, and the degree to which such research is connected to and informed by basic and applied research and development.

The benefits are two-fold. First, having ready access to colleagues in science and engineering informs our thinking about policy and ethical issues, which in turn enables us to advise them on how policy and ethical concerns affect basic research, product development and technology adoption. All of this makes for a lively and truly interdisciplinary discourse. Equally important, these collaborations benefit students across the disciplines. They show our students that the greatest insights about any problem are derived from spanning disciplinary boundaries.

Nanotechnology is a vast area. From your perspective, what is the greatest potential for developments in the field?

It is hard to imagine any sector that won't be reshaped. Perhaps the most exciting breakthroughs are in areas

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The work at CHN and other research laboratories here and elsewhere point to revolutionary breakthroughs in the continued miniaturization and speed of computing in the near future, making your iPhone a clunky monster by comparison. It borders on the stuff of science fiction.

Breakthroughs in nanomedical applications — including a lot of work at Northeastern — portends fundamental shifts in how we detect and treat cancer, devise therapies for neurological diseases like Parkinson's or enhance the body's capacity to heal itself when damaged. The prospects for a future where we are able to effectively deal with cancer, Alzheimer's or diabetes is a startling one and merits our close attention along all kinds of policy and ethical dimensions.

What are the near- and long-term environmental and health concerns about nanotechnology, and how do we address them?

Short term concerns are rather prosaic and largely focused on ensuring that those working in laboratories and production facilities aren't exposed to potentially harmful engineered nanoparticles, and that they practice proper disposal procedures in dealing with nanomaterial waste.

Longer-term concerns include the extent to which nanoparticles are toxic to human and animal health — for example, whether cosmetics containing engineered nanoparticles have harmful long-term effects — and the possibly harmful side effects of nanomaterials introduced into the environment for otherwise beneficial reasons, such as injecting iron nanoparticles into the soil to remediate chemical-saturated "brownfields."

What is the appropriate role for government in all of this?

It is not always obvious. As citizens, regardless of overall ideology or partisan views, at minimum we expect government to address those risks that we as individuals can neither understand nor personally control. And we expect government to do so in some reasonably responsive and transparent way. And we also want government to promote economic growth, technological innovation and human health.

These are all balancing acts —and often, difficult ones — so the "appropriate" role for government will depend on our own priorities. And that requires citizens to be more aware of and critical about the benefits and possible costs of revolutionary technologies.

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