

Social and Ethical Dimensions of Nanofabrication

**Priscilla Paul, General Engineering, Concentration in Biomedical Engineering,
The Cooper Union for The Advancement of Science and Art**

NNIN REU Site: Cornell NanoScale Science and Technology Facility, Cornell University

*NNIN REU Principal Investigator: Prof. Bruce Lewenstein, Departments of Communication,
and Science & Technology Studies, Cornell University*

*NNIN REU Mentor: Ana Viseu, Ph.D, Department of Science & Technology Studies,
and Cornell NanoScale Facility, Cornell University*

Contact: paul@cooper.edu, b.lewenstein@cornell.edu, viseu@cnf.cornell.edu

Introduction:

This project focuses on the social and ethical dimensions of nano research and development. During this project at the Cornell NanoScale Facility, ethnographic work and interviews were conducted with a diverse group of researchers ranging from undergraduate students, to staff members and industry users, and a video was produced that reflects some of the themes which emerged from these conversations and investigations. Research participants discussed the social dimensions of making science by interacting with others and sharing the lab with them, how safety an overriding concern, research's toll on the environment, and expressed their opinions on public communication and how it relates to hype and funding. Looking at all these factors, some were then able to speak about the future and the difficulties of navigating the world of Nano. Put together, these findings allude to the centrality of social and ethical issues, often considered extra-scientific, in the practices of nano-researchers. The resulting video is just the beginning of the studies to come on the social and ethical dimensions of nanofabrication.

Procedure:

To begin, background reading was done of articles and reports on the subject of nanotechnology such as *The Big Down: From Genomes to Atoms* [1] by the Erosion Technology and Concentration Group (ETC), and *Societal Implications of Nanoscience and Nanotechnology* [2] by the National Science Foundation (NSF). Organizing these readings helped build a database of such materials. Next, the lab was visited and ethnographic work was performed, studying the users and their interactions with one another and the machines, and engaging in conversation and informal interviews with undergraduate students, staff members, and industry users. We asked about which issues involved in doing nanotechnology research were most important to them. Several questions were asked such as what project they were working on, how the

products of their research would benefit the world, what their greatest worries were working in a clean room, and various other issues related to nano research such as toxicity, privacy and surveillance, environmental issues, hype and expectations, equity, and necessity of public communication, among other topics.

Results:

The interviews gave a greater understanding of the large number of issues that compose the world of nanofabrication—economics, politics, definitions, safety, and uncertainty, among others. Their diverse character offers a glimpse into the difficulties of navigating the world of nano-related-research. CNF, being a lab shared by students, users, and staff, brought to light some of the social dimensions of making science, “communal lab living rules” that users had to follow to coexist in the lab and avoid obstacles. Failure to follow these guidelines would result in inefficient utilization of resources and hinder the research process. Some of these lab rules extended to negotiating and outlining the rules of doing research in shared conditions. For instance, how staff members' contributions of to a user's research should be acknowledged or how staff can juggle their professional identities as staff, lab technicians and researchers.

One of the most recurrent concerns was safety. In order to ensure the safety of the facility and of all users, all NNIN sites follow strictly enforced work procedures and regulations. These require that all operations be undertaken with the safety of both the individual user and other users as the primary consideration.

The need for strict regulations regarding the process of nanofabrication points to the larger interactions of science, with society and the environment, and proves that the social dimensions of Nano go beyond the confines of the lab and involve the community at large. In doing so, we come to realize the importance and necessity of communicating with the public. Consultation and communication have proved to be the

best ways to build trust and maintain a balance between public and scientific interests. They are also a way of informing the public of the some of the differences between the reality portrayed in the media and science fiction, and realities of nanofabrication and research. For many people, the media is their only entry point into laboratory life. Having no other comparison, it becomes difficult to differentiate between facts and fiction. In recent years, nanotechnology has been introduced to the general public most noticeably through works of science fiction.

Most of the researchers interviewed agreed that the kind of hype promoted in the media and sci-fi has always led to high unrealistic expectations of science and technology, and has also led to fomenting fear of the fictitious devices designed in these science thrillers. Yet, at the same time, they also agreed that playing on hype may lead to a funding advantage. By using certain eye-catching words that funding agencies consider cutting edge, they may be nudging their proposals to the top of the pile. It should not come as a surprise that the interaction between what sponsors and benefactors want to hear and are willing to fund, and what researchers feel compelled to specify in their applications, shape the kinds of projects that make it into the lab. This means that hype should not be dismissed as a mere media game. It plays an important role in framing the present and future of nano-research.

Future:

The results of this study are not meant as definite answers. Instead, they are starting points—part of a larger NNIN research effort that aims to increase knowledge of the perspectives on Social and Ethical Dimensions of Nano. To this effect, a number of other researchers are conducting surveys and other empirical research. The main point is that all these social and ethical issues, that are seemingly extra-scientific or everyday concerns, are actually central to the process of doing nanotechnology; they are what people in the lab deal with in their everyday work. They complement each other and make Nano what we know it to be.

Acknowledgements:

I would like to thank Ana Viseu and Bruce Lewenstein for their continued support and writing and editing assistance, and Brant Penman for video production. I would also like to thank all the CNF users that participated in the interviews, especially those that appear on the video, Mike Skvarla, Robert Stundtner, and Meredith Metzler.

References:

- [1] ETC Group. 2003. *The Big Down: Atomtech - Technologies Converging at the Nano-scale*. Winnipeg, Canada.
- [2] Roco M.C. & Bainbridge, W.S. (eds.). *Societal Implications of Nanoscience and Nanotechnology*, Dordrecht: Kluwer, 2001.
- [3] Paul, Priscilla, *Exploring the social and ethical dimensions of nanofabrication*, video, <http://www.sei.nnin.org/archive.html>.