

# Ethics Between Nanoscience and Nanotechnology: Making Space for a Discussion

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# Ethics of Nanotechnology

1. What will nano-society be like?
  - What changes will Nano bring?
  - How do we educate and engage the public?
    - Nano-literacy
    - Democratic Public Engagement
2. Environmental, Health and Safety issues
  - Nanotoxicity and Public Awareness
  - Product Life Cycles
3. Social Justice and Nano
  - The “nano-divide” – who has access?

# How nano is affecting the pursuit of scientific and technological knowledge?

- How is nano being made?
- Profoundly interdisciplinary
  - Chemistry, Physics, Molecular Biology, Mechanical, Chemical, Electrical, Biomedical Engineering, MSE, Medicine &c.
  - “Between” quantum and classical
  - Between science and engineering
  - NSF’s problem  $\Rightarrow$  National Nanotechnology Initiative
- Convergence of enabling technologies in 1990s (Microscopes, molecular biology techniques, simulations &c.)

# Linear Model Outdated?

- What happens when applied science affects basic science?
- Disciplinary identities become unstable
  - Science education affected
- Funding paradigms change
- Social structures of knowledge communities change
- We lose our way of understanding the (scientific) world
  - linear model did work, it was robust

# Knowledge Communities

- Application–driven
- Capacities
- Resources
- Constraints
- Norms (social, epistemological)
- Problem-oriented
- =INTELLECTUAL ENVIRONMENT

# Intellectual Environment

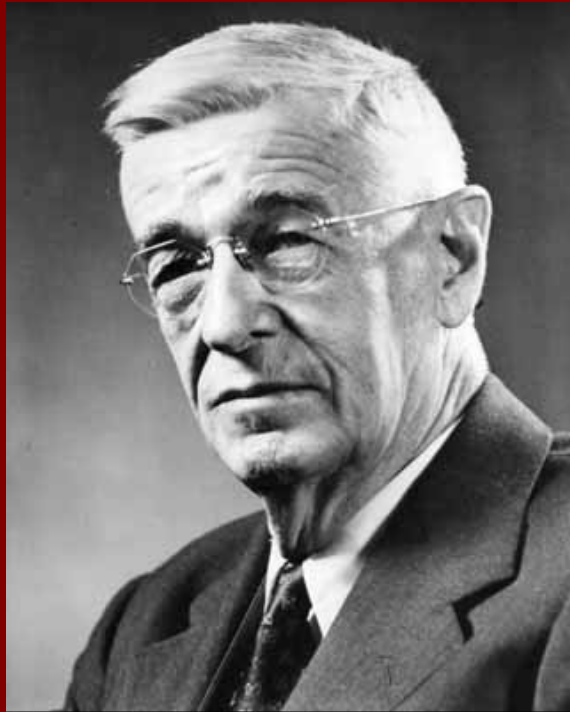
- Space for Ethical Discussion - element of knowledge community
- Ethics defined, in part, by knowledge (belief)
- Ethics defined, in part, by social structure
- Ethics, Social Structure, Knowledge (epistemology) define “Community”

# The Bridgman Position

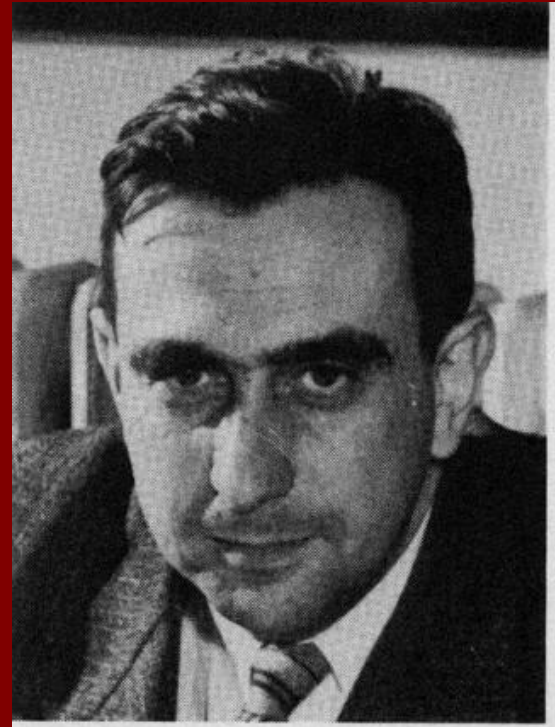
- Ethical questions are tied to applications; *products* affect the world, not knowledge
- Scientists cannot control the applications of the knowledge they create
- Scientists are not trained to take on ethical questions
- Scientist's motivation, intent, agency matter



# Bridgman Adherents



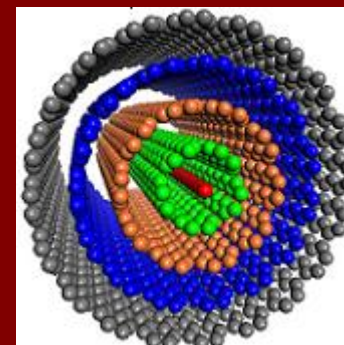
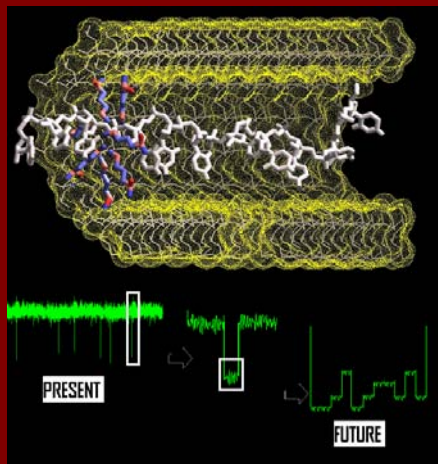
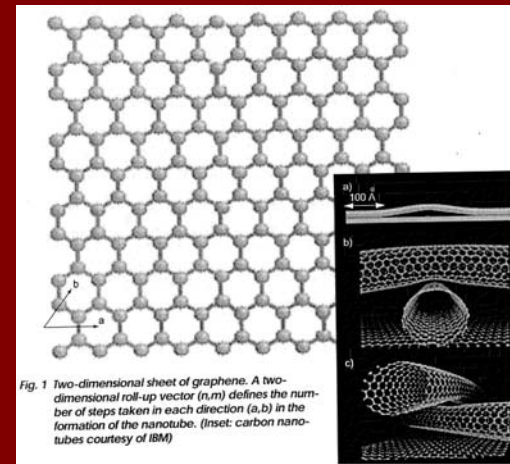
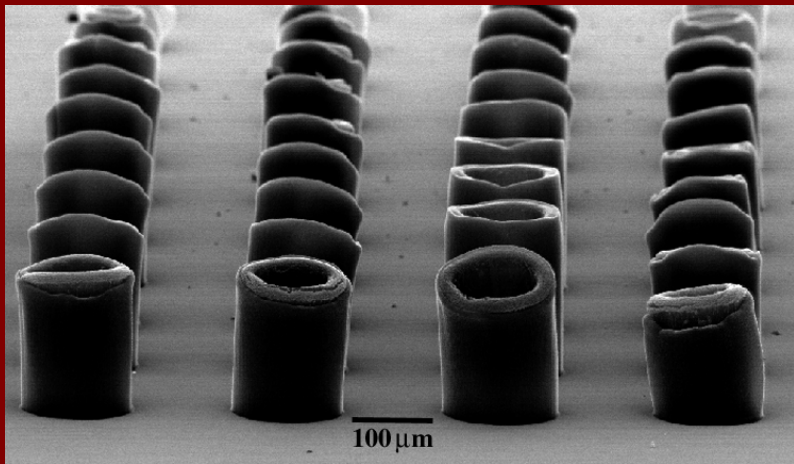
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# The Bridgman Position -- Problems

- Motivation & Agency – Scientist's intent
- Not applied RIGHT now
  - Unapplied vs. Inapplicable (*ever*, or at least for foreseeable future)
- Funding matters— you can't have your cake and eat it too!

# “Unapplied” science?

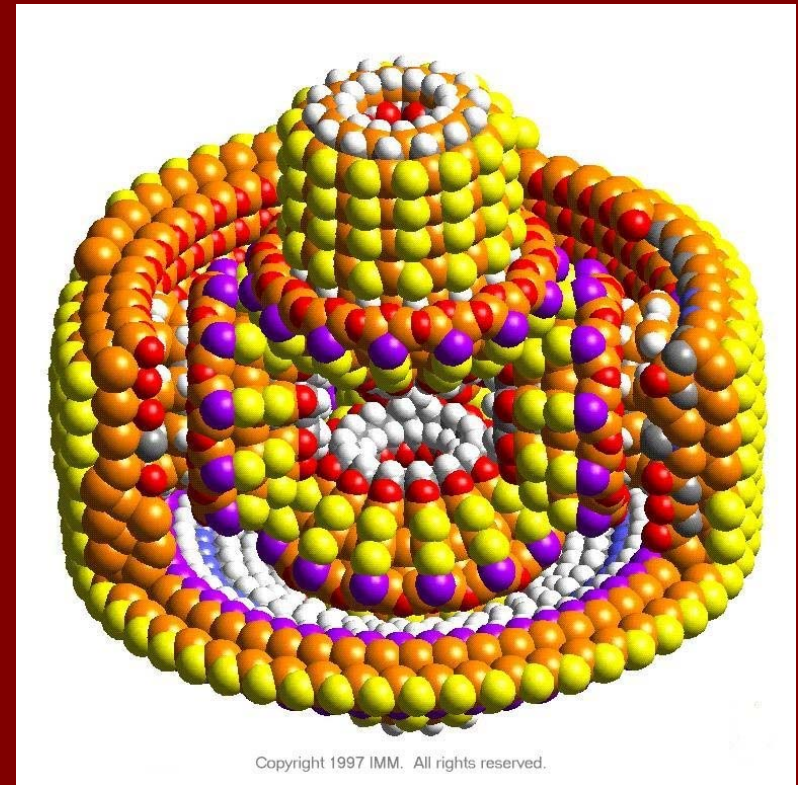


# The heart of the problem: Science and Engineering are different

- Why do ethics matter for engineers?
- Engineering knowledge isn't knowledge for knowledge sake
- Engineers design things they expect will affect society
- Nano lies between basic and applied science, between science and engineering

# Not Science vs. Engineering Look at Design

- Applied science as a design activity
- Design has ethical space
- Design is a knowledge form
- Design is a social process
- Manipulating objects – what for? To make something else?  
=DESIGN



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