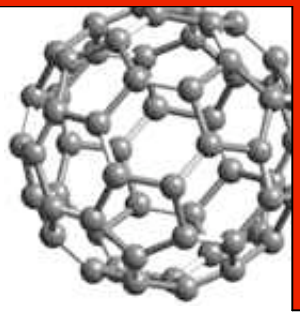
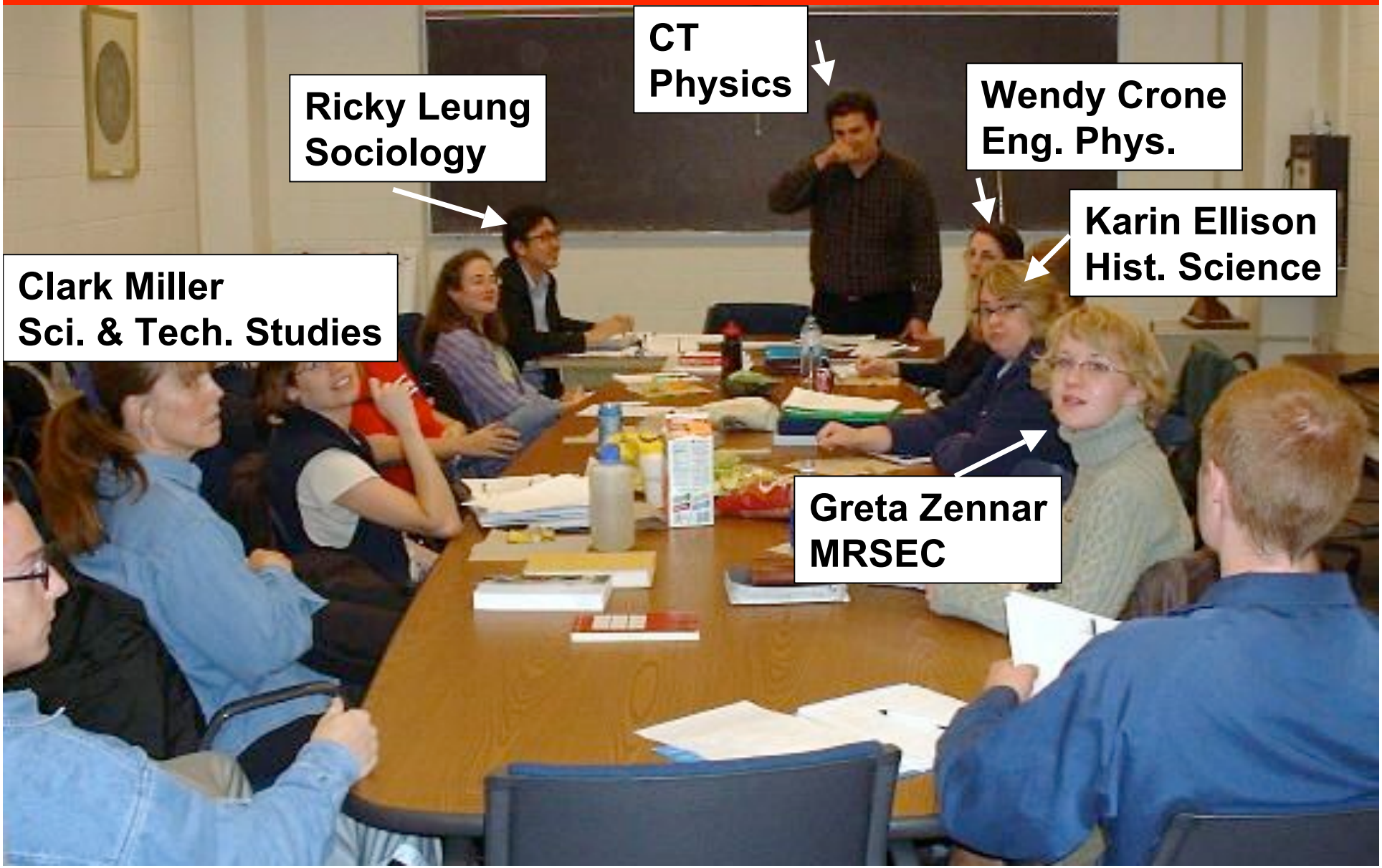
Nanotechnology and Society



Charles Tahan
Physics Department
University of Wisconsin-Madison
APS March Meeting, March 22, 2005

The People

NUE: ***An Integrated Approach to Teaching Nanotechnology and Society***

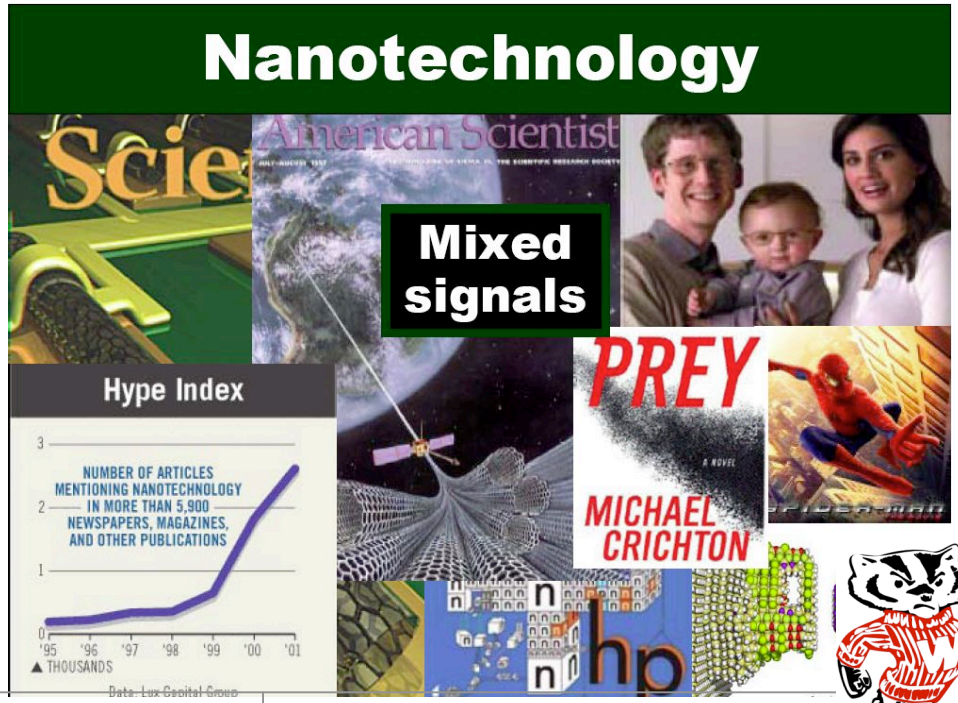


Background

- **Societal Implications of Nanotechnology**
- **Proposal for Nano & Society teaching at UW**
- **Undergraduate Course (Spring '05)** ***"Nanotechnology and Society"***
  - Sci. and Tech. Studies 201, 2 sections, 3 credits
  - 2 Graduate students: **Ricky Leung (Sociology) and CT (Physics)**

"The National Nanotechnology Initiative sets aside $80 million out of $774 million for education and societal implications ($30m), and environmental studies ($50m) in 2003."

- M. C. Roco, NSF



Preparation for Class This Spring

- **Graduate Seminar last fall**
- **Introduction to materials - sociological texts/ nanotech readings**
- **"Clash of civilizations"**
- **Led by graduate students**
- **Chance to test active learning/discussion techniques**

Examples:
- **Think-Pair-Share**
- **Jigsaw**
- **Town-meeting format**
- **Group discussion**
- **Black-board exercises**
- **…**

(Organized by G. Zenner, W.Crone, C. Miller, K. Ellison)

My class

STS **201**: Nanotechnology and Society, and Freshman (and Sophomores, and Juniors, and …).

Freshman (4)
Sophomores (11)
Juniors (4)
Seniors (4)

Mixed class.

Atmospheric & Oceanic Sciences
Biology
Biochemistry (**4**)
Botany
Business/Marketing (**2**)
Chemical Engineering
Communicative Dissorders
Computer Science/Eng. (**5**)
Legal Studies
Mathematics
Nuclear Engineering (**2**)
Pharmacy
Zoology
Undecided

Pre-assessment

PRE ASSESSMENT

STS 201: Nanotechnology and Society

Section 84405

Please rate your comfort level with the following topics.	Very Comfortable	Comfortable	Slightly Comfortable	Not Comfortable
1. The science of nanotechnology.	☐ 0%	☐ 17%	☐ 48%	☐ 35%
2. Any science or engineering field.	☐ 36%	☐ 36%	☐ 28%	☐ 0%
3. Science and society issues.	☐ 21%	☐ 42%	☐ 33%	☐ 1%
4. Nanotechnology and society.	☐ 0%	☐ 22%	☐ 43%	☐ 35%

Pre-assessment

Where did you first hear the term nanotechnology?

1. News/Internet/TV
2. This class
3. Science fiction
4. Pop-sci
5. Sister's boyfriend
   Bill Clinton
   Feynman
   A video game

Define nanotechnology.

- Study/tech of small particles/minute/very, very small tech (6)
- Study/design/manufacturing of products/objects at nanoscale (5)
- "…to make our lives easier/better/improve society" (4)
- Technology involving microscopic particles
- "minute scale"
- Technology on nanometer scale
- Modification and altering of nanoparticles or atoms (1)
- Larger than a single atom and smaller than a living cell (1)
- 10^{-9} meters (1)

Pre-assessment

Give three examples of nanotechnology applications.

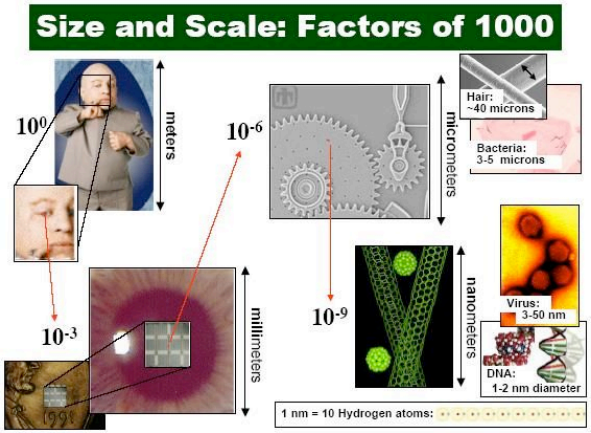
Really, Really Fast Computers/chips (7)
Carbon nanotube particles
Water resistant fabrics
Stain free pants (3)
Fiber Optics
Biotech (2)
Quantum Dots (2)
CPU lithography
Microchips
LCD screens

Stained glass (8)
Medicine/Medical things (4)
Surgery
Robotics
Synthetic diamonds
Nanobots (2)
Sensors and data acquisition
Agriculture (2)
Military
Sensors

Curriculum

TEXTS:

- **Hand-made course reader (sociological, science and technology studies, history of science, science policy, nanotechnology reviews)**
- **Understanding Nanotechnology (SciAm Press)**



Syllabus

1. Introduction to Nanotechnology and Society
2. Topics in Nanoscience
3. Nanotech in Culture
4. Revolutions and the History of Science and Technology
5. Technology and Society
6. *How Government Drives Technology*
7. Weighing the Risks
8. Policy Reports and Reviews
9. Thinking about the Future

Congressional Mock Hearings/Town Hall Meetings

1. Nanotech Funding: Should the government continue funding of nanotechnology research?
2. Public Participation: Should the public have an active role in the evolution of nanotechnology? How?

Research Project and Presentations

1. Summary report on a key nanotechnology, it's applications, and it's implications.
2. 25 students, 25 technologies.
3. Result: Pamphlet on Nanotechnologies for the lay person.

Nanotech Example

Quantum dot nanocrystals

- Bulk-"Nano" transition
- Optical properties: bandgap, photons
- Atom-like properties
- Bands become energy levels
- "Cool or Hot, Quantum or Not"

Silicon nanocrystal

Nano+Society Example

6. How Government Drives Technology: **Military and Tech**

Reading:

(Policy) **M. C. Roco,** *The US National Nanotechnology Initiative After 3 Years*, **Journal of Nanoparticle Research, 6: 1-10, (2001-2003)**

(Society/STS) **David Noble,** *Command Performance: A Perspective on Military Enterprise and Technological Change*, **in Military Enterprise and Technological Change (Cambridge: MIT Press 1987).**

- **Performance, Command, Modern Methods**

(News) **D. Talbot,** *Super Soldiers*, **in MIT Tech Review Oct 2002, 105(8): 44-50.**

(Science) **Video: Institute for Soldier Nanotechnologies**

Working through it:

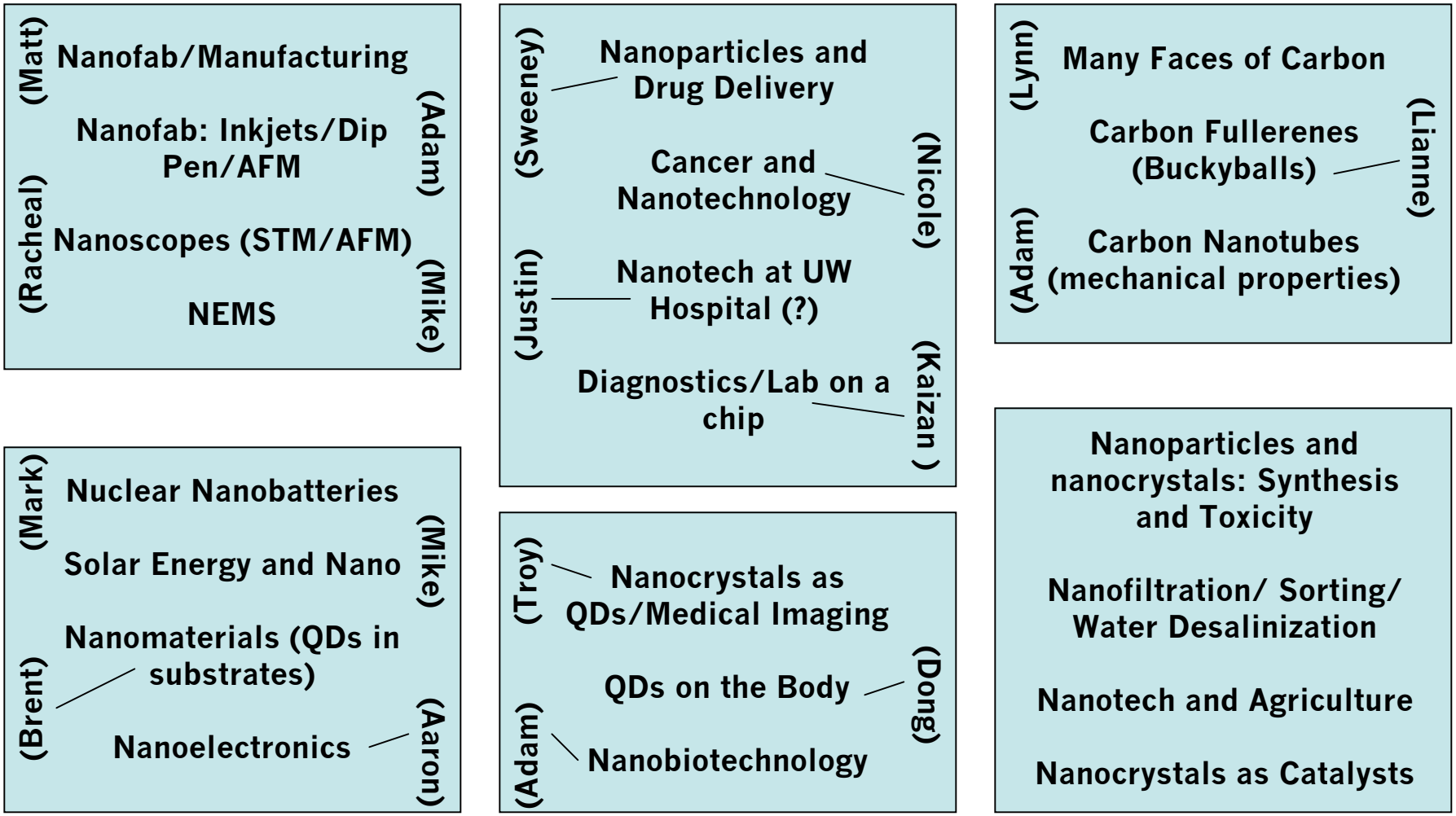
Debates, Town Hall Meeting, Discussion, Essay

Rumsfeld vs. Langdon Winner

Research Projects

"Centers of Knowledge"

Professional article for a lay audience: science/societal implications.



Output

- Research Reports
  1. **Summary report on a key nanotechnology, it's applications, and it's implications.**
  2. **25 students, 25 technologies.**
  3. **Result: Pamphlet on Nanotechnologies for the lay person.**
- Curriculum materials / Course portfolio
- Did it work? (assessment)
  - T - 1 month to go
  - Write something up.

Wisconsin Initiative on Nanotechnology and Society
http://www.lafollette.wisc.edu/research/Nano/

http://tahan.com/charlie/