Potential Research Project Topics

All the projects have nanoscience and societal implications parts. The goal is to make a professional summary of a specific nanotechnology and its implications.
Due dates:

Friday, Feb. 25: Top three choices (or proposed new choice) with a paragraph explanation of why.
Friday, Mar. 18: Outline of research project with major themes and focus points of what you want to do. Including some references.
Mar. 18- Apr. 8: Meet with me at some point to discuss sources for your research and direction.
Friday, Apr. 8: First full draft due.
Apr. 8 – Apr. 29: Give a 10-15 minute informal talk to the class on what you've learned so far.
Friday, Apr. 29: Final paper due.

1) Nanotechnology and Agriculture
Potential applications of nano in agriculture. ?

2) Nanoelectronics
Quantum wires and nanotubes for electronics. Molecular electronics. Implications for infotech.

3) Lateral Quantum Dots
Quantum wells in semiconductors. Physics of a quantum dot. Single-electron transistors. Applications to nanoscience and electronics.

4) Nanocrystals: Synthesis and Toxicity
How are nanocrystal quantum dots made? How are they sorted? Coated? What are the toxic ramifications?

5) Nanocrystals as Quantum Dots
General physics of semiconductor and metallic quantum dots. Quantum size effects. Optical properties. Implications and uses.

6) Toward Infinite Storage
Magnetic hard drive tech today: giant and colossal magneto resistance (GMR, CMR). Ideas to get to the nanoscale. Implications.

7) Nanocrystals as Catalysts
Reactivity of nanocrystals. Superthermites (e.g. for bombs, rocket fuel). For chemical reactions (clean up environmental pollution/spills?)

9) Nanomanufacturing
Top-down vs. bottom up. Implications on the manufacturing industry (help/hurt rural US?, etc.).

10) Nanofabrication: E-Beam Lithography vs. Photolithography
How they work. The problems and benefits of lithography for fabrication and historically.

11) Nanofabrication: Can Inkjets Make Anything?
Dip-pen lithography. AFM fabrication. Inkjet techniques

12) Seeing Small (Overview of Electron Microscope to Scanning Probe Microscopes)
How they work. Why they are so important to everything else.

13) Nanoscopes? The Scanning Tunneling Microscope
How it works. Applications.

14) Image and Control: The Atomic Force Microscope (and its cousins)
How it and its cousins work. Applications.

15) The Many Faces of Carbon
Diamond, why it's amazing. Other allotropes: graphite, fullerenes. Discussion of synthesis techniques for fullerenes. Overview of implications.

16) Carbon Nanotubes
Physical properties, possible applications, implications.

17) Carbon Fullerenes
Physical properties, possible applications, implications.

18) Nanomedicine with Quantum Dots
Cancer treatment. Antibacterial properties.

19) Nanomedicine: Diagnostics
For contrast imaging/tagging. On-chip DNA testing.

20) Nanobiotechnology?
If this is a field what is it?

21) Nanomaterials (Embedded quantum dot materials)
Nanoparticles embedded to make things stronger (e.g. tires). Solar cells of quantum dots in conducting polymers. What else?

22) Nanoelectromechanical systems (NEMS)
Motors and mechanical systems on a pin head. Microfluidics, "lab on a chip". MEMS/NEMS

23) NanoNukes?
Nuclear batteries in micro/nano semiconductor structures

24) Energy and Nanotechnology
Carbon nanotubes to hold hydrogen? Better solar conversion?