NanoTech 101

What is NanoTechnology and........
where is it taking us???
What is “nano”? 

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CONSEQUENTLY.... Nano Tech is......

- The Science of Small Things How Small?
- An examination of the world at one billionth of a meter \(10^{-9}\)
- The placement, measurement, and manipulation of atoms and molecules with extreme precision
Why should you care???

Almost every industry will be affected by nanotechnology.

It has a lot of support:

- In 1999 President Bill Clinton started the NNI (National Nanotechnology Initiative) to accelerate & fund R&D.
- In 2003 President George Bush signed the 21st Century Nanotechnology R&D Act. Funding is at a record 3.7 billion dollars through 2007.
- Europe, Japan, Israel, Taiwan, China & Singapore have similar stuff going on.

It could make you a lot of money!
What has NanoTechnology brought to our world so far.........

The pencil-thin iPod nano -
It’s 4 GB NAND flash memory is created using Nanotechnology.
Fat-Busting Canola Oil

Made from an Israeli company called NutraLease
Because of their size (30 nm), they can seep through tissues for a better delivery of nutrients.
Has show to reduce LDL cholesterol by 14%
Tootsie Roll's Choco'la
Chewing Gum

Ever had chocolate chewing gum?

No? That’s because the fat’s in chocolate causes chewing gum to fall apart and lose its elasticity.

They were able to get past this problem by modifying the crystal surfaces at a nano-scale.

You can find it either on their website or at specialty chocolate stores in Chicago. $1.25 for 12 pieces. Great Price!
Zelen Fullerene C-60 Day Cream

- It turns out that the material has remarkable antioxidant properties.
- $250 per jar.
- It uses Nano-scale Fullerene Carbon 60
  - This is where 60 Carbon Atoms are arranged in the shape of a soccer ball.
Easton Sports Stealth CNT Bat

- CNT stands for “Carbon NanoTube Technology”
- Your ordinary, run-of-the-mill carbon fiber bat contain only resin, which weakens the bat’s power
- So they put Carbon Nano Tubes in the bat’s resin
- It gives more responsiveness and "kick" through the hitting zone for maximum performance
- Will cost you $175 and up.
Stink-Proof Nano Soxs

- They incorporate 19nm size silver particles within their fibers.
- It has permanent resistance to odor and fungus.
Golf Balls And The "Nano" Driver

Tokyo-based Maruman & Co. has adopted fullerenes from Honjo Chemical for use in the top of the line "New Majesty" driver, which went on sale on July 5 of 2004. Compared to conventional titanium, the new driver resists bending 12% better, has a hardness 3.6% better than titanium, a 20% more resilient head and an increased flight distance of 15 yards as compared to their old 360cc class driver.

Buffalo, N.Y.-based NanoDynamics might have a nice accompanying stocking stuffer. NanoDynamics came up with a golf ball that can correct its own flight path. The design of the ball--and the undisclosed nanomaterials it's made of--serve to better channel the energy received from the club head, and thus correct a wobble or slight drift. The ball is expected to hit stores in the spring of 2005.
3M Dental Adhesive

Having a porcelain veneer, tooth restoration or root canal work soon? Your dentist just may put nanoparticles in your mouth to help your new crown stick better. As we featured in our September story, "3M: Practicing Nanotechnology Without the Hype," 3M ESPE, a 3M subsidiary in dental adhesives, announced a new option in total-etch dental adhesives: Adper Single-Bond Plus Adhesive. The new adhesive incorporates a silica nanofiller technology that forms a stronger bond to tooth enamel and does not need to be shaken by dentists prior to using in order to prevent particle clustering, which can decrease performance.
Military-Grade Disinfectants

Used on Navy submarines, cruise ships, aircrafts and healthcare facilities, San Jose, Calif.-based EnviroSystems’ EcoTru nanoemulsive disinfectant cleaner cleans and disinfects in one step. In the post SARS virus scares of 2003, Boeing recommended EcoTru for use on airplanes, which helped EnviroSystems attract 30 airlines as customers. Currently, EcoTru is the only EPA-registered Tox Category IV disinfectant product in the U.S. This means there are no harmful dermal (skin), ocular (eyes), inhalation (breathing) or ingestion (swallowing) effects.
Footwarmers
(Shock Doctor/Aerogel Hotbeds)

Northborough, Mass.-based Aspen Aerogels launched a nanotechnology-based footwarmer in March of 2004, which is now used by the 2004 winner of the North Pole Marathon, the Canadian Ski Team and the U.S. Military’s Elite Special Forces. Aspen’s Pyrogel AR5401 utilizes highly-insulative nanoporous-aerogel technology, providing 3-to-20 times more thermal performance at a given thickness when compared to existing materials.

Plymouth, Minn.-based Shock Doctor has developed a product called Hotbeds, which is being used in military boots for improving the level of comfort in cold weather operations. Since the Pyrogel AR5401 is so efficient, the Hotbeds are only 2.5mm thick.
What will 2008 bring us?

**CHEMICALS:**

- Creation of custom materials with specific electronic, optical & chemical properties desired for the given application.
- New combinations and compounds will add strength, reduce weight, improve resistance or electrical conductivity.
COMPUTING AND STORAGE

- Greater than 40x improvements in data storage/retrieval, allowing for the storage of up to 1 terabit of data per square inch.
- A new frontier of computing where matter is as readily programmable and manipulated as software and lines of code.
- Non-volatile Flash Memory, eliminating the need to "boot-up" computers.
Currently, NanoTechnology is allowing for the cost of chip fabrication facilities to be decreased by tens of billions of dollars.

WHAT DOES THIS MEAN???

Everything that uses semiconductors will become cheaper for us to purchase!
Nano-Filters to take the lead out of gasoline could be a cost savings of 80 to 90% of the refining oil costs.

Over the next decade Nano-structured catalysts will have a $100 billion impact on the petroleum and chemical processing industries.

NanoTech will advance our ability to store hydrogen in Hydrogen Fuel Cells. Automobiles are now being made to use liquid hydrogen rather than gasoline.
BIOTECHNOLOGY

- Tissue Engineering
- Enabling drugs to go directly to the location where they are beneficial (they’re already working on this in cancer research and diabetes research)
- Point of care diagnostics and therapeutics

**BIOSENSORS**

- Will be able to detect bacteria, viruses and even more inside of DNA!
- There will be much more of this as you go through all your science classes in GRPS as we are part of a NSF grant to work on BIOSENSORS
Viruses range in size from 20 nanometers (nm) - 250 nanometers (nm)

1 nm = 0.00000004 inches

If a cell was the size of your classroom, then an average virus would be the size of a softball.
Forbes/Wolfe Nanotech Report 2002
www.forbesnanotech.com
