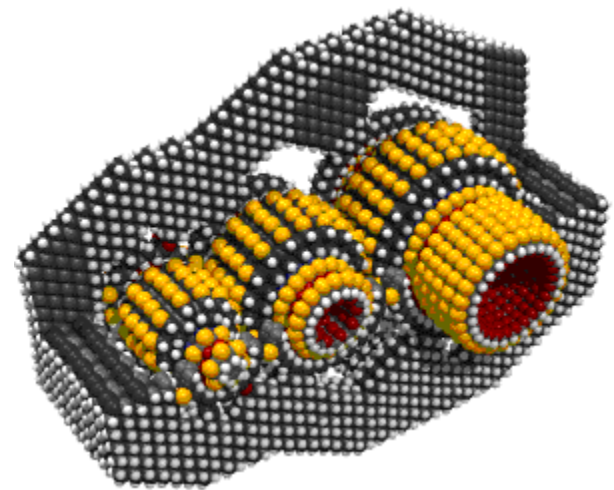
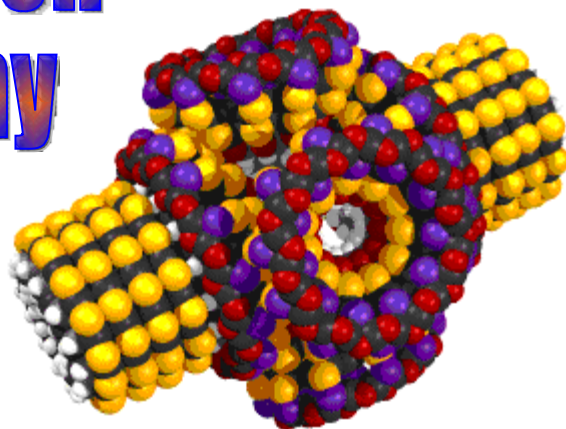
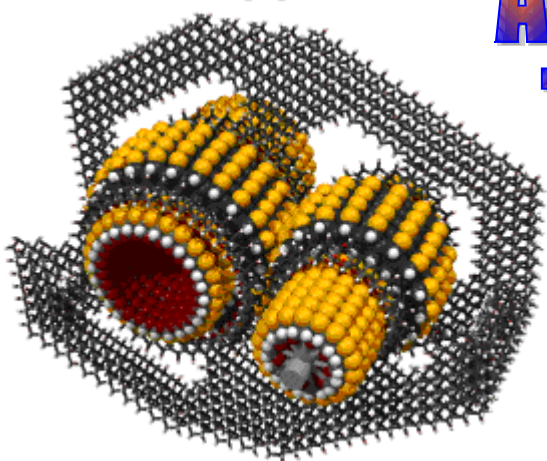
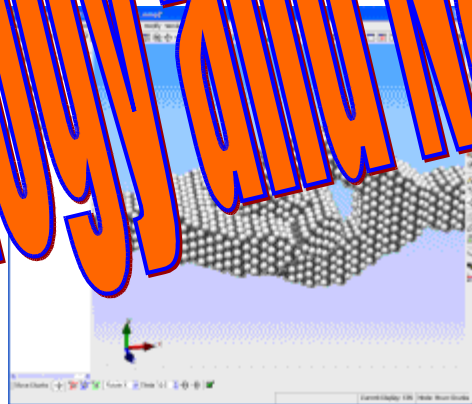
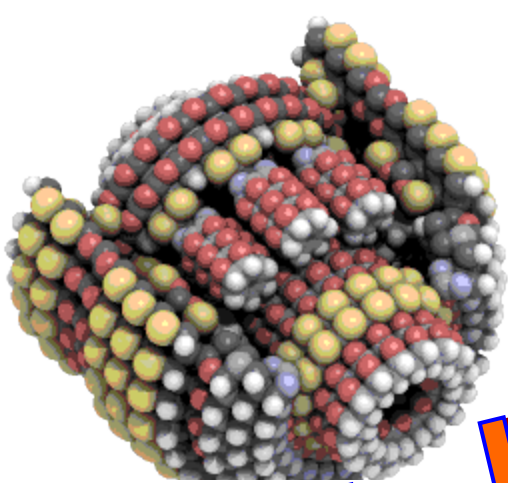


Nanotechnology and Nanomedicine

Allison
Tony



OBJECTIVES

Students will learn:

- 😊 About nanotechnology
- 😊 About nanomedicine
- 😊 About nanobots
- 😊 How nanotechnology will change your life
- 😊 The future of healthcare using nanotechnology
- 😊 About different nanotechnologists

History of Nanotechnology



- Richard Feynman was the first scientist to suggest that devices and materials could someday be fabricated to atomic specifications: "The principles of physics, as far as I can see, do not speak against the possibility of maneuvering things atom by atom." Later the term nanotechnology was coined. Today nanotechnology is reshaping technology.
- In the late 1970's, Eric Drexler began to invent what would become molecular manufacturing. He quickly realized that molecular machines could control the chemical manufacture of complex products, including additional manufacturing systems-which would be a very powerful technology. Drexler published scientific papers beginning in 1981.

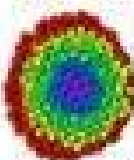
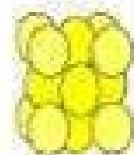
Nanotechnology



- Nanotechnology is an expected future manufacturing technology that will make most products lighter, stronger, cleaner, less expensive and more precise.
- The science and technology of building devices, such as electronic circuits, from single atoms and molecules

History

- The first use of the concepts in 'nano-technology' (but predating use of that name) was in "There's Plenty of Room at the Bottom," a talk given by physicist Richard Feynman at an American Physical Society meeting at Caltech on December 29, 1959. He described a process by which the ability to manipulate individual atoms and molecules might be developed, using one set of precise tools to build and operate another proportionally smaller set, so on down to the needed scale.



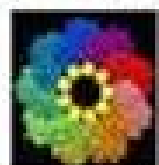
1st: Passive nanostructures

(1st generation products)

- a. *Dispersed and contact nanostructures*. Ex: aerosols, colloids
- b. *Products incorporating nanostructures*. Ex: coatings; nanoparticle reinforced composites; nanostructured metals, polymers, ceramics

↑
Frame 1
↓

~ 2000



2nd: Active nanostructures

- a. *Bio-active, health effects*. Ex: targeted drugs, biodevices
- b. *Physico-chemical active*. Ex: 3D transistors, amplifiers, actuators, adaptive structures

↓
Risk Governance Frame 2
↓

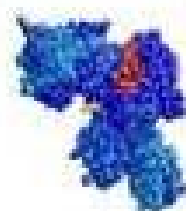
~ 2005



3rd: Systems of nanosystems

Ex: guided assembling; 3D networking and new hierarchical architectures, robotics, evolutionary

~ 2010



4th: Molecular nanosystems

Ex: molecular devices 'by design', atomic design, emerging functions

~ 2015-
2020

↓

BIOCLEAN SELF-CLEANING GLASS

- SGG BIOCLEAN uses UV light and rain to actively break down dirt so your windows stay cleaner for longer.
- A transparent coating on the outside of the glass harnesses the power of both sun and rain to efficiently remove dirt and grime.
- Only a small amount of sunlight is required to activate the coating so the self-cleaning function will work even on cloudy days.
- The coating is based on photocatalytic nanoscale Titanium dioxide
The SGGBIOCLEAN self-cleaning coating, applied as the glass is made, is permanent and stays on the glass for the lifetime of the window, unlike other wax-like 'easy-clean' products, which may need reapplying.

normal glass

SGG BIOCLEAN®



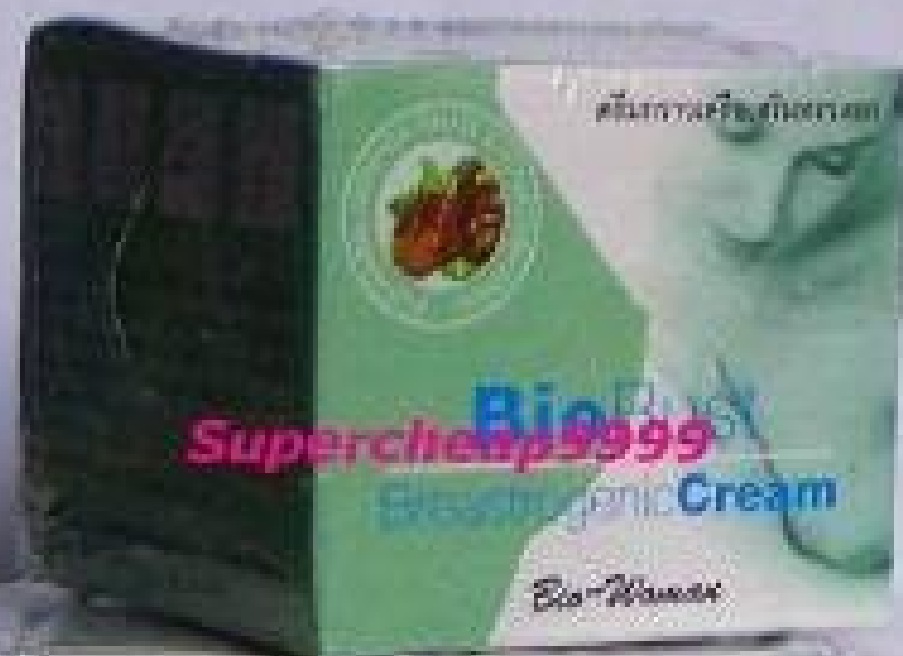
Normal glass



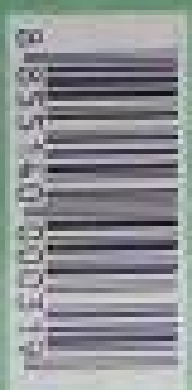
SGG BIOCLEAN

Pueraria Mirifica

- St.herb Nano Breast Cream is harmony combination of Nanotechnology and the timeless Thai herb, Pueraria Mirifica.
- Nanosomes are oxidation stable compound which expands the cellular substructure and promotes development of the lobules and alveoli of the breasts.
- Nanosomes are protected from Surface & bulk erosion also, this feature provides added advantage - Toning of Breast Skin, visible cleavage, radiant texture of breast skin & protection from free radicals.



ส่วนประกอบ	ส่วนประกอบ
น้ำ	น้ำ
น้ำ	น้ำ
น้ำ	น้ำ
น้ำ	น้ำ



วิธีใช้

ใช้ครีมทาหน้าก่อนนอน หรือก่อนอาบน้ำ เช็ดหน้าให้แห้ง แล้วทาครีมให้ทั่วหน้า ทาซ้ำอีกครั้งก่อนนอน

สามารถใช้ทาทั่วตัวได้

สามารถใช้ทาทั่วตัวได้

สามารถใช้ทาทั่วตัวได้

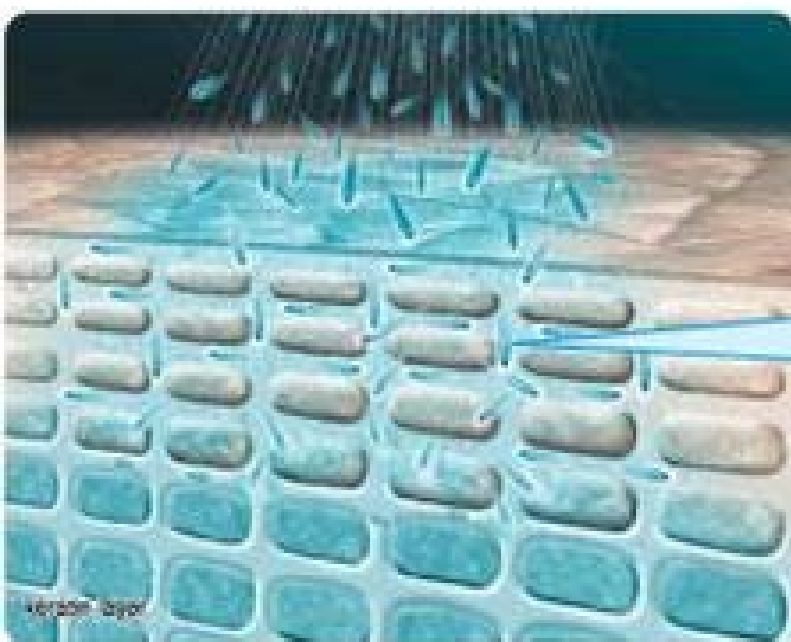


Facial Iconic Steamer



- Refines pores by deeply moisturizing keratinized cells in the outermost layers of the skin with nano size Ionic Steam.
- Heat is at a temperature 5 degrees higher than body temperature, Deep moisturizing, enhancing collagen, closing pores, reducing wrinkles and balancing excessive facial oil
- Manufactured by Panasonic

Penetrates deeply into keratin due to its nano particles ion steam.



The volume of nano size at the cell level is approximately 1/8000 that of ordinary steam.

Ordinary steam

No penetration over skin surface.



The particles begin drying immediately after normal steam is being used. The large size steam particles inhibit penetration of moisture and promote evaporation.

Nano particles ion steam

Deep penetration



The ultra small 'nano-size' moisture particles easily penetrate through the most outermost layers of the skin and get deeply trapped in the keratinized cells.

Skin is filled with moisture



The pores closed



Skin condition is improved and pores closed.

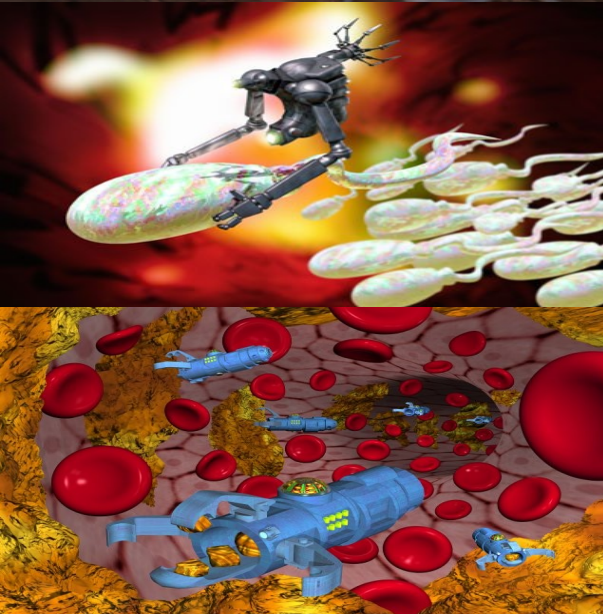
Nanomedicine

- Nanomedical approaches to drug delivery center on developing nanoscale particles or molecules to improve the bioavailability of a drug.
- Nanoparticles of cadmium selenide (quantum dots) glow when exposed to ultraviolet light. When injected, they seep into cancer tumors. The surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal.
- It is greatly observed that nanoparticles are promising tools for the advancement of drug delivery, medical imaging, and as diagnostic sensors. However, the biodistribution of these nanoparticles is mostly unknown due to the difficulty in targeting specific organs in the body.





CG image by Retinal Reality ©2002
Do not reproduce without written permission



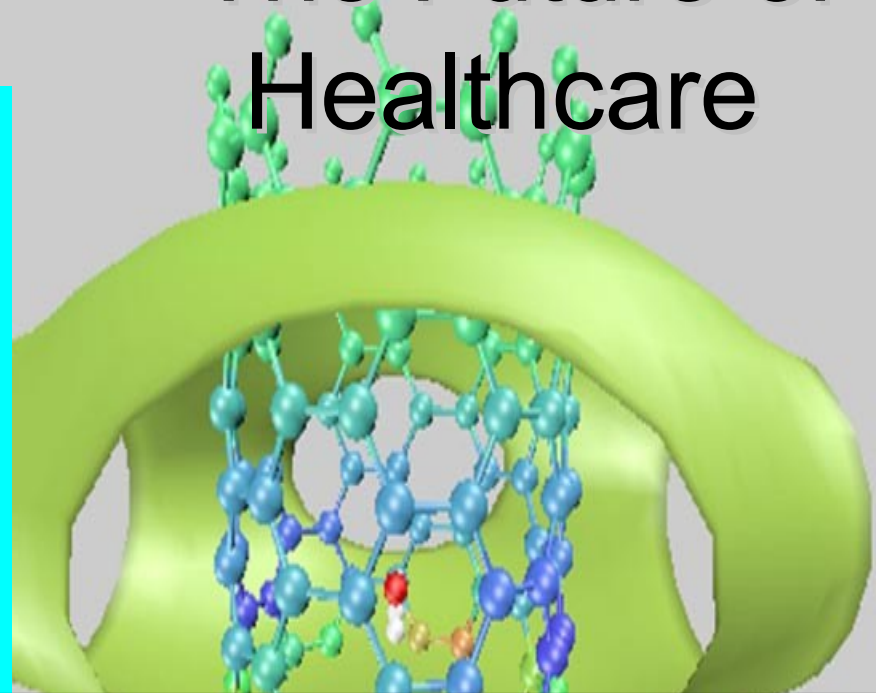
- ▶ This nanobot is futuristic that enhances your brain cells giving you more space for knowledge and learning
- ▶ This nanobot is also futuristic, it is were you can have sexual contact and not get pregnant
- ▶ This nanobot is also being worked on but it is used to clean up your cholesterol in your blood stream

Nanobots

- The technology of creating machines or robots at or close to the microscopic scale of a nanometers
- Credit is given to Eric Drexler for the creation of nanobots.
- In the human body, nature has made its own organically-constructed machines to assist in our survival - for example, white blood cells move freely around in our blood systems selectively locating and destroying invading counter-productive life forms and toxins

The Future of Healthcare

- Nanomedicine will soon be able to restore blind nerve cells restoring light sensitivity making blind people able to see, public health workers in Bangladesh could place contaminated water into transparent bottles, which when placed in direct sunlight could disinfect the water and help prevent water-borne diseases like cholera, dysentery or polio, medical technicians in Vietnam could use a tiny "reporter" molecule that attaches itself to specific bacteria or viruses in a patient sample and read with an inexpensive laser device -- no bigger than a briefcase -- whether an infectious disease is present, and a nurse in Brazil could dispense a gel that would stick to the AIDS virus surface like molecular Velcro and prevent it from attacking healthy cells in sexually active women



Empirical Nanotube Model for Biological Applications

Carbon nanotubes are being proposed as nanodevices for drug delivery, DNA transfection, and biosensing. They can also be employed as nanopores that conduct protons, ions, and small molecules, or as reaction vessels for new types of chemical reactions.

Nanotechnology Kills Cancer Cells

- The technique works by inserting microscopic synthetic rods called carbon nanotubes, which are coated with folate molecules. This makes it easier for them to pass into cancer cells, but unable to bind with their healthy cousins.
- When the rods are exposed to near-infra red light from a laser they heat up to about 70C in two minutes, killing the cancer cell, while cells without rods (healthy cells) are left unscathed.

Tiny tubes are
implanted in cancer
cells

Can We Have New Limbs?

YES!!!

YES!!!



New Limbs



Biotech revolution

Smarter prosthetics bestow greater control on amputees

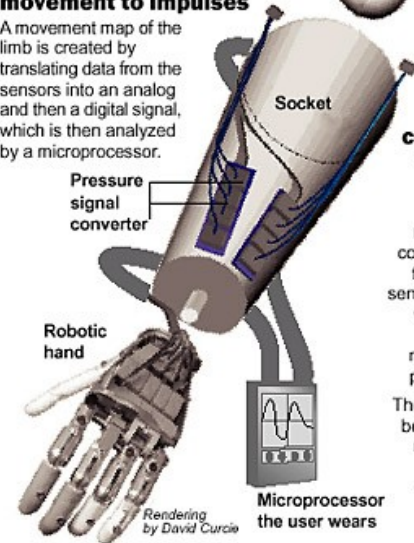
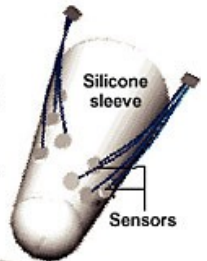
The convergence of computer technology, electronics, and materials science has reshaped prosthetics, the field of replacing missing body parts with artificial ones. The newest bioengineered prosthetics use computer sensors to let amputees have more control over their mechanical limbs. Here is a look at how an advanced, experimental prosthetic works.

Sensors monitor muscle movements

Many patients are able to make some tendon and muscle movements in their amputated limbs. The extent of this movement differs from person to person. As many as 32 sensors are placed in a grid to capture the person's range of motion.

Sleeve translates movement to impulses

A movement map of the limb is created by translating data from the sensors into an analog and then a digital signal, which is then analyzed by a microprocessor.



Computer coordinates movement

The pre-programmed microprocessor correlates signals from the motion sensors in the limb with the signals controlling the movements of a prosthetic hand.

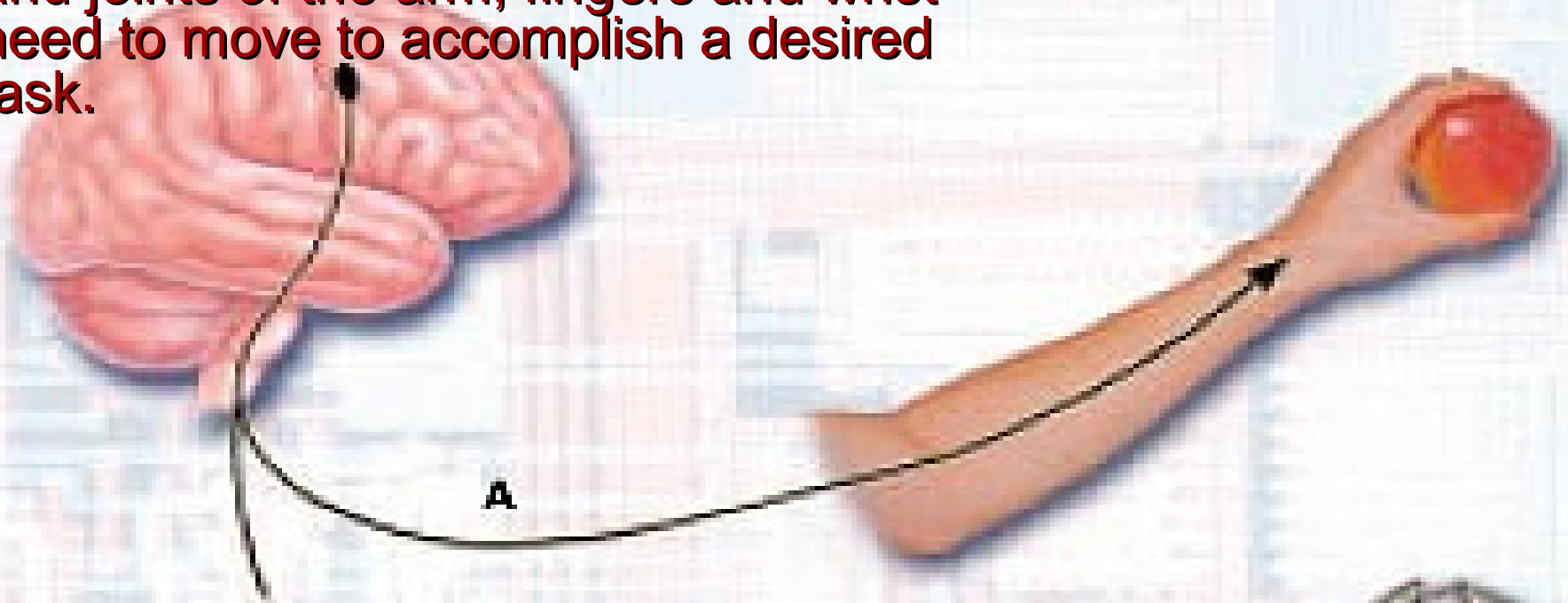
The computer can be customized to most effectively translate user commands into motions of the robotic hand.

SOURCES: Department of Biomedical Engineering, Rutgers University

AP

- Nanomaterial can replace the tissue scaffolds for replacement of human limbs and organs
- You are also able to use robotic limbs

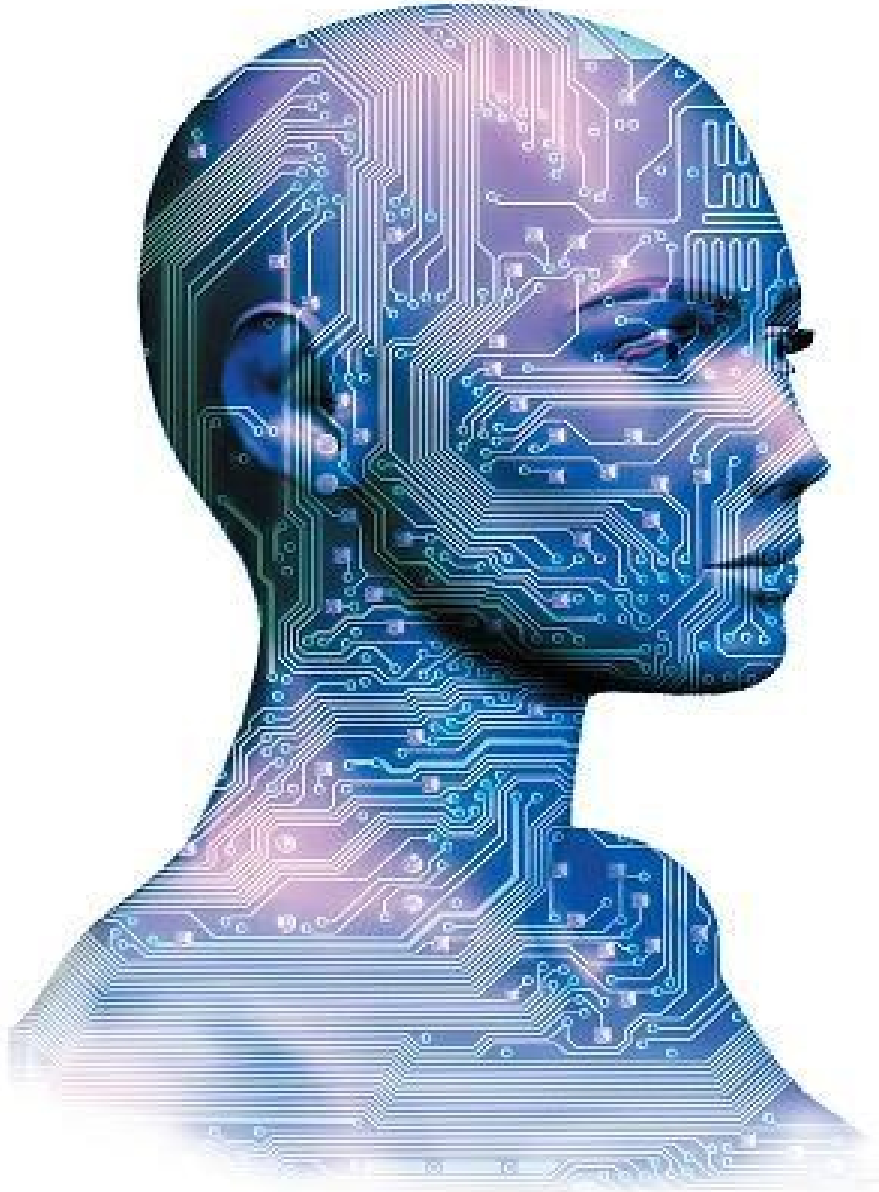
- A) The brain emits a barrage of signals that form a plan on how the muscles and joints of the arm, fingers and wrist need to move to accomplish a desired task.



- B) In an effort to counter the problem, several groups of researchers are testing systems in animals that can interpret brain signals and launch movement in robotic limbs. With further advances, they hope that disabled people will be able to incorporate the robotic devices into part of a representation of their body and regain



Enhancements



- The new human enhancements will open the door to "enhancements" of the body — better IQ, appearance, and capabilities. These enhancements will definitely benefit many, but they also bring up important moral, ethical, and legal questions that human society has not yet had to face.
- In the long run, nanotechnology would enable us to analyze and repair any physical ailment in the body.
- This would mean that nanotechnologies would be able to repair someone who is damaged or diseased back to full health; an aged body and brain could be restored to a youthful state.
- The more controversial enhancements would likely be "unnatural" enhancements to human talent: extreme intelligence and memory capacity, significantly heightened sense of awareness, astonishing athletic capability and strength, and beauty enhancements are just a few examples.

Nanoprobes

- It uses a very small optical fiber which shines light on a sample and the vibration reflections of the light can be measured with such precision that samples can be accurately characterized and identified. The technique is wonderful for analyzing very small molecules of things like chemicals, explosives, and drugs.



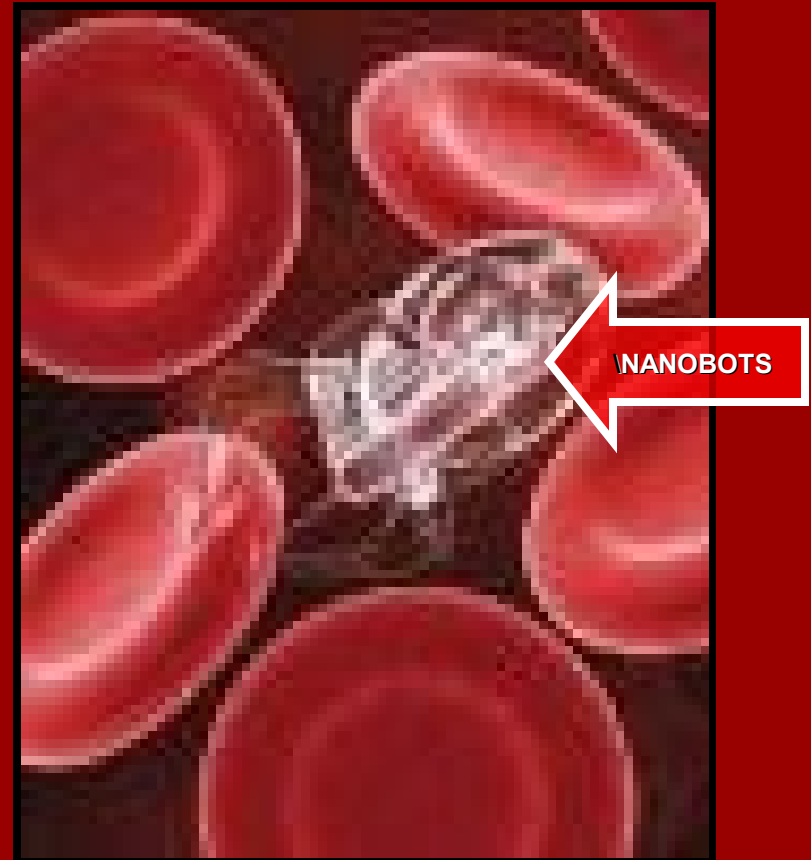
Nanoprobes today



- The process was developed by tapering an optical fiber to a tip measuring $100\text{ nm} = 1000\text{ Angstroms}$ wide. A very thin coating of silver nanoparticles is added to enhance scattering effect of the light. The reflected light demonstrates vibration energies unique to each object (samples in this case), which can be characterised and identified.

Nanorpobes in Red Blood Cells

- Nanoprobe depicted in the future, traveling among red blood cells. In coming years, the nanoprobe will evolve from basic diagnostics, to enhancements and repair. This will be the start of truly nanotech medicine.



Legal Issues

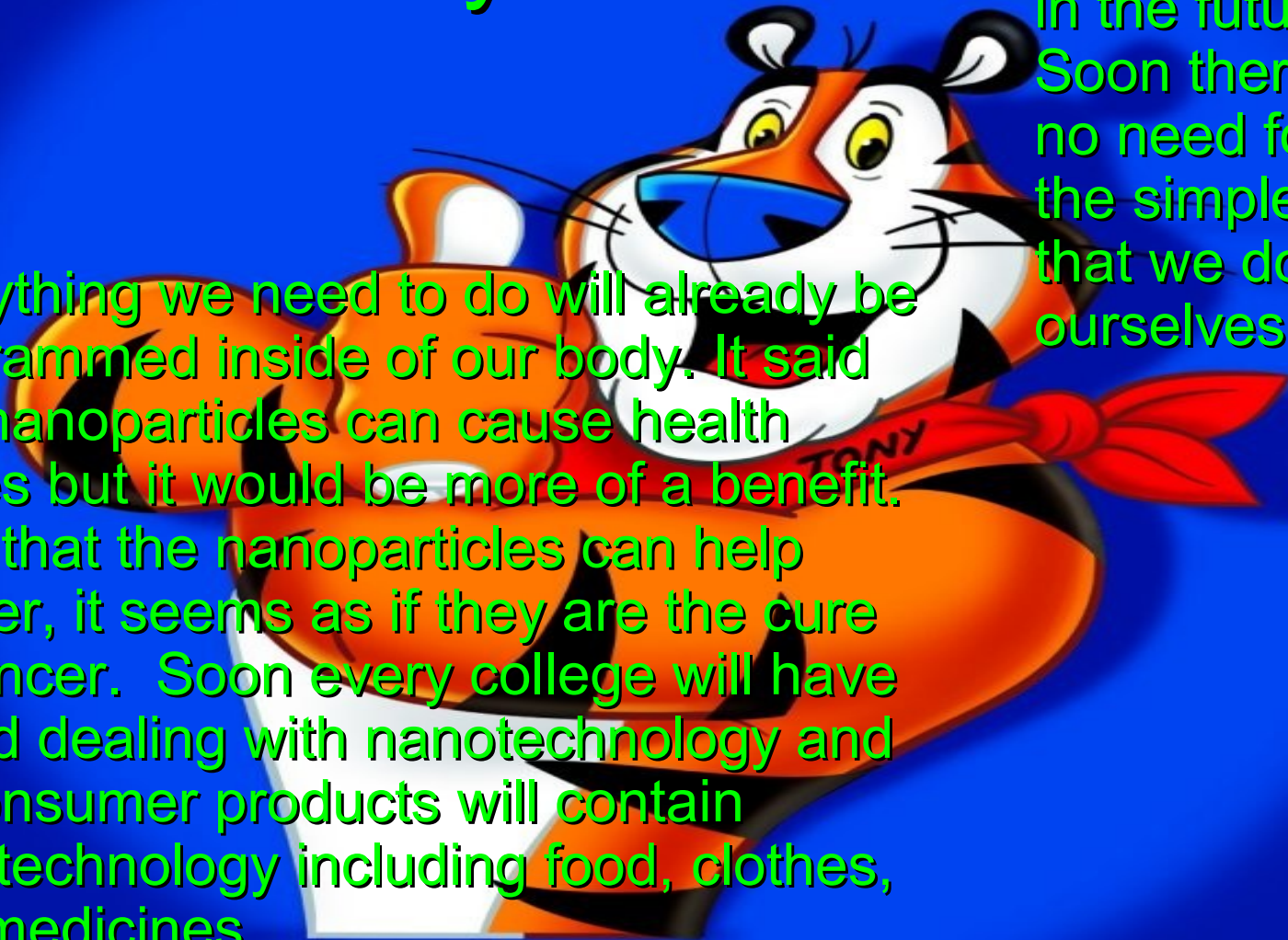
- The National Institute of Occupational Safety and Health (NIOSH), released an Interim Guidance for the Medical Screening of Workers Potentially Exposed to Engineered Nanoparticles. What they are saying is that they do not agree with engineering objects involving nanoparticles because it is an health risk, although increasing evidence indicates that exposure to some engineered nanoparticles can cause adverse health effects in laboratory animals and they are testing to see if it will effect human beings as well.
- Pesticide & Toxic Chemical News reports that chemical manufacturer DuPont and the nonprofit organization Environmental Defense are developing a joint framework for risk assessment of nanomaterials. The framework itself is for "the responsible development, production, use and disposal of nano-scale materials that identifies, manages, and reduces potential risks across all lifecycle phases. they will be passing laws soon on nanotechnology to control the technology and not let it get out of control

Allison's Commentary

• I think that nanotechnology is a great invention it is going to be able to do many things in the future.

Soon there will be no need for all of the simple things that we do ourselves.

- Everything we need to do will already be programmed inside of our body. It said that nanoparticles can cause health issues but it would be more of a benefit. I like that the nanoparticles can help cancer, it seems as if they are the cure of cancer. Soon every college will have a field dealing with nanotechnology and all consumer products will contain nanotechnology including food, clothes, and medicines.



Tony's Commentary



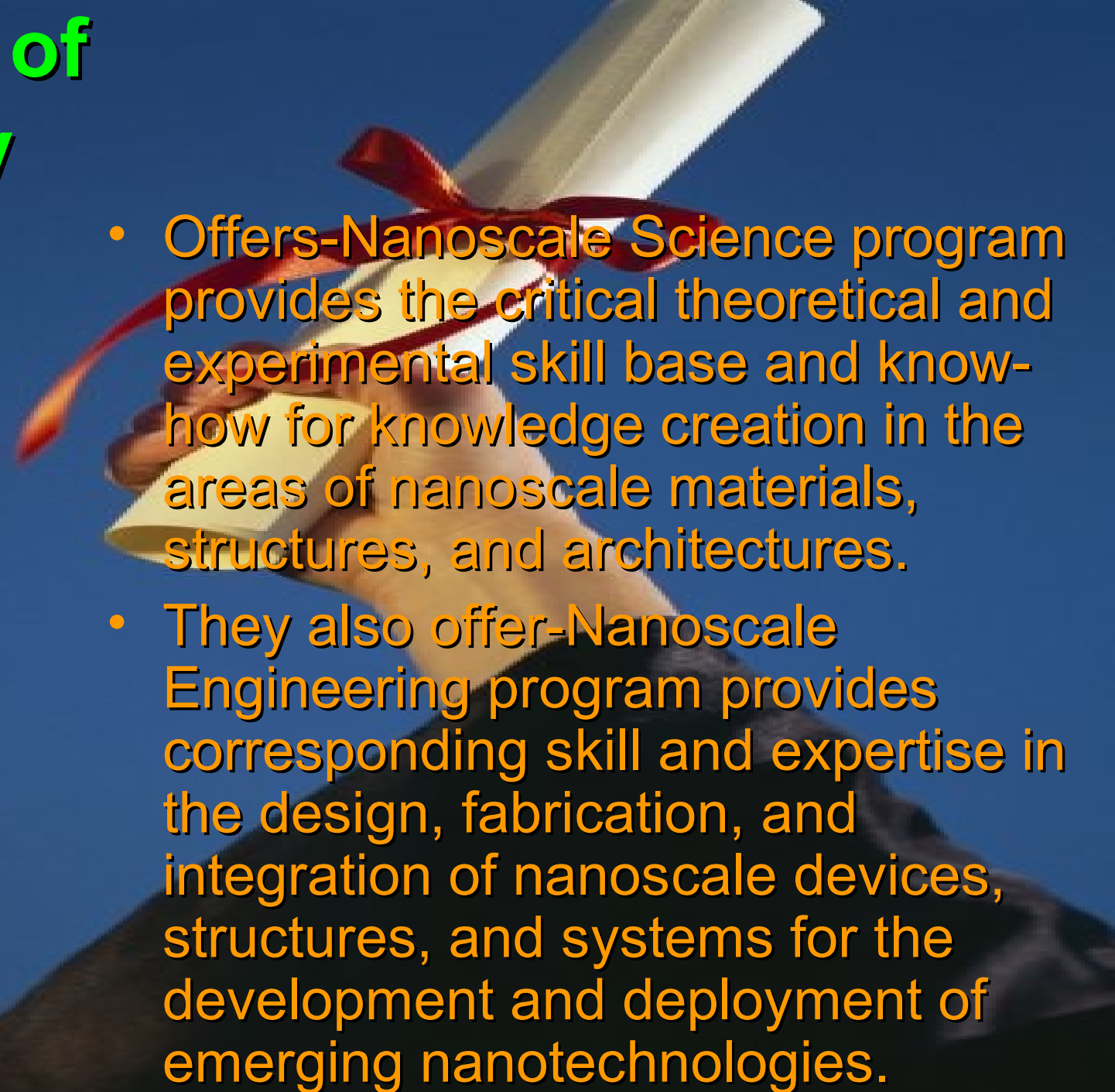
- My commentary on this project would be that it has taught me a lot about nanotechnology. My whole perspective on nanotechnology has broaden. Now I think that nano is a good thing to have because it gives you the ability to do things you never thought you would be able to do. My prediction about nanotechnology is that it will benefit us in the near future, but we need to watch ourselves because this technology could fall into the wrong hands if we are not careful with our technology.

Rice University

- Rice University built their first nanocarbon October 21, 2005.
- The Richard E. Smalley Institute for Nanoscale Science and Technology at Rice University, this specifically focuses on technology on the nanometer scale.



College of Albany

- 
- Offers-Nanoscale Science program provides the critical theoretical and experimental skill base and know-how for knowledge creation in the areas of nanoscale materials, structures, and architectures.
 - They also offer-Nanoscale Engineering program provides corresponding skill and expertise in the design, fabrication, and integration of nanoscale devices, structures, and systems for the development and deployment of emerging nanotechnologies.

Ph. D. Program in Nanotechnology

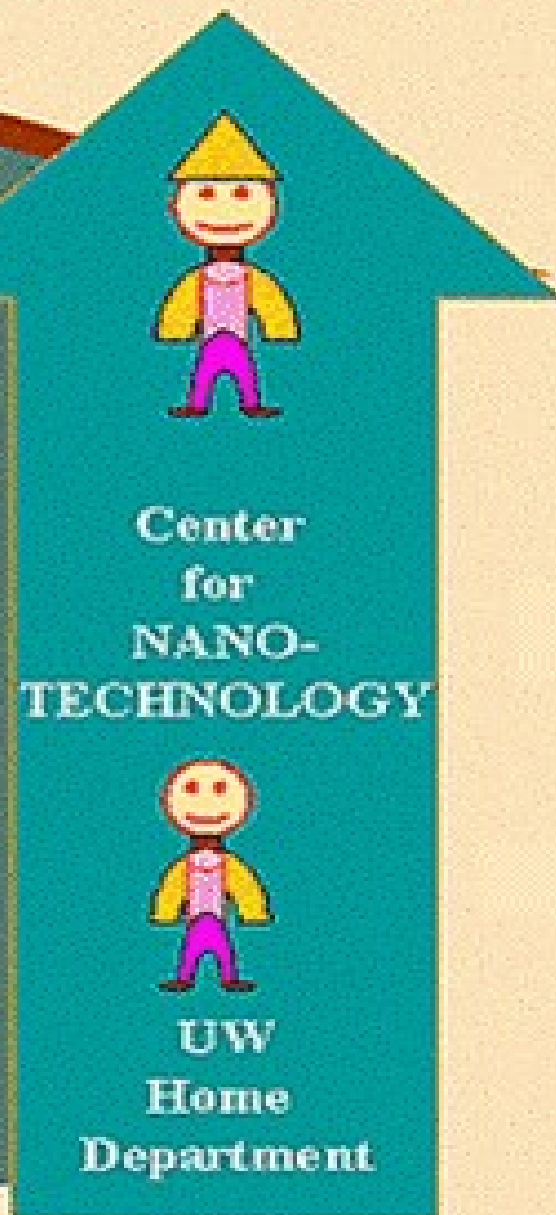
University
of Washington

Required:

- Nanorelated Courses outside home department (about 50 courses)
- Rotation in lab outside the home department
- Thesis in nanoscale science & nanotechnology
- Nanotech seminar

Options:

- *NanoTech User Facility*
- *Industry or PNNL Internship*
- *Mentoring Program*
(Center for Workforce Development)
- *"Future Faculty Training" Certificate*
- *"Entrepreneurship in Technology" Certificate*

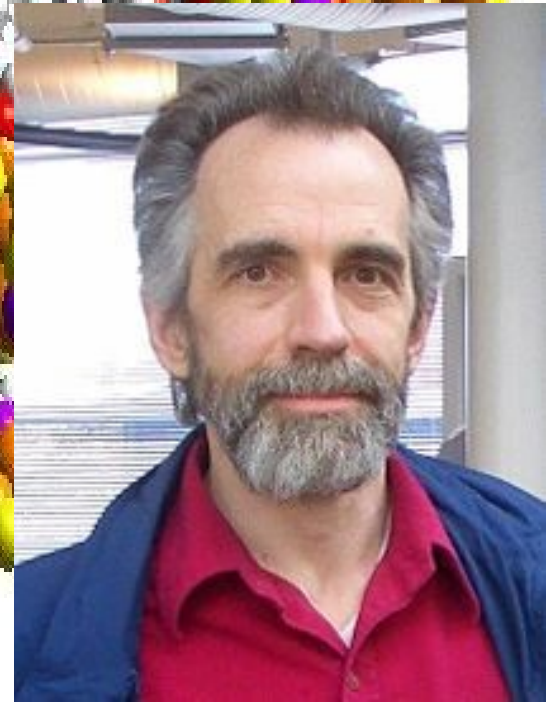
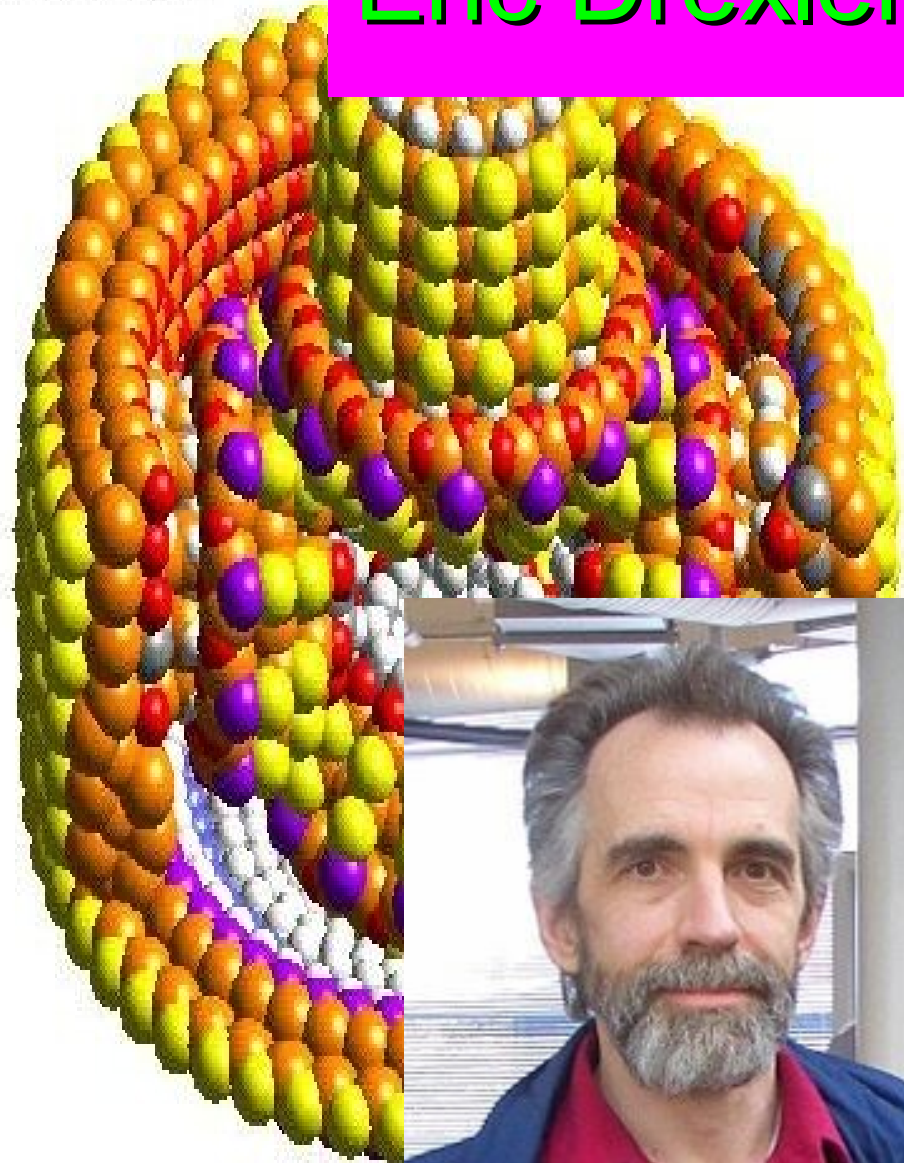


NSF-funded IGERT Program

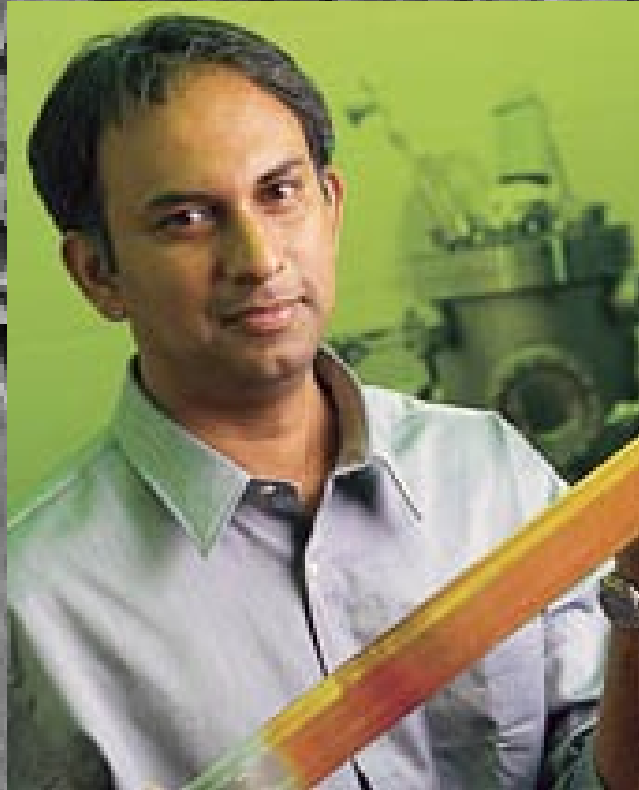
Eric Drexler

A cross-eyed stereo pair

- A researcher and author whose work focuses on advanced nanotechnologies and directions for current research.
- Drexler and his wife at that time founded the Foresight Institute in 1986 with the mission of "Preparing for nanotechnology."



Pulickel Ajayan



- He is noted for leading advances in carbon nanotube technology.
- He teamed with to develop the first method for making macroscopic quantities of nanotubes.
- They demonstrated that nanotubes can be produced in bulk quantities by varying the arc-evaporation conditions.

David Britz

- An American scientist and engineer who is best known for his contributions to the field of materials science and nanotechnology.
- In 2004, Britz and his colleagues at Oxford and the University of Nottingham won a place in the Guinness Book of World Records for creating the world's smallest test tube, by performing chemical reactions inside of carbon nanotubes: "the nanotube has an inner diameter of approximately 1.2 nanometres, and a length of about 2 micrometers. Its volume is two zeptolitres (a zeptolitre is 10^{-21} liters), and around 2,000 molecules react in that space."



URL's

- ✓ <http://microscopy-uk.org.uk/mag/indexmag.html?http://microscopy-uk.org.uk/mag/art97/nano1.html>
- ✓ http://images.google.com/imgres?imgurl=http://www.imm.org/Images/diffGearStereo.jpg&imgrefurl=http://www.imm.org/research/parts/gear/&h=388&w=769&sz=103&hl=en&start=4&um=1&tbnid=ef8_N4DygpFpM:&tbnh=72&tbnw=142&prev=/images%3Fq%3Deric%2Bdrexler%26um%3D1%26hl%3Den%26safe%3Dactive%26rlz%3D1T4ADBS_en__US246%26sa%3DN
- ✓ <http://www.nanobot.info/>
- ✓ news.rpi.edu/.../update.do?artcenterkey=1481
- ✓ http://en.wikipedia.org/wiki/Pulickel_Ajayan
- ✓ http://en.wikipedia.org/wiki/David_Britz
- ✓ www.rsc.org/.../Volume/2005/1/oldindex.asp
- ✓ <http://crnano.org/whatis.htm>
- ✓ <http://en.wikipedia.org/wiki/Nanomedicine#Cancer>
- ✓ <http://www.nano.gov/html/edu/eduunder.html>
- ✓ <http://cenamps.blogspot.com/2007/02/using-nanotechnology-to-improve-health.html>
- ✓ www.ks.uiuc.edu/Research/Categories/Nano/all.cgi
- ✓ <http://news.bbc.co.uk/1/hi/health/4734507.stm>
- ✓ <http://www.fpl.fs.fed.us/resources-products/fpl/fs--nanotechnology--future-in-wood-products-industries.pdf>
- ✓ <http://www.media.rice.edu/media/NewsBot.asp?MODE=VIEW&ID=10630>
- ✓ <http://library.thinkquest.org/05aug/01179/nanobots.html>
- ✓ http://nanoengineer-1.com/content/index.php?option=com_content&task=view&id=40&Itemid=50