Nanomedicine Nanotubes

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Nanotechnology is one of three new frontier technologies in 21st century. If we were asked for an area of science and engineering that will most likely produce the breakthrough of tomorrow, we should certainly point to nanoscale science and engineering.

Nanometer is the scale of atoms and molecules, and Nanotechnology offers the tools to control how materials are made and how devices function at the atomic and molecular level. With this level of control, the possibilities to create new materials and new devices are unlimited. Advances in nanotechnology have led to the discovery of a growing number of new artificial materials including the carbon nanotube that has emerged as a critical component of the nanotechnology.

What are Carbon Nanotubes?

Carbon nanotube is a new carbon allotrope that was first discovered in 1991 . It has a nanometer-scale hollow tubular structure and a different atomic arrangement from graphite, diamond and C_{60} bucky-ball C the other three known carbon structures. Its unique and promising properties have attracted the attention of researcher around the world and led to active R&D (research & development) efforts in the commercial industries.

The image on the left illustrates that a single-wall carbon nanotube (SWNT) (in red) can be conceptually constructed by a single graphite plane. Experimentally produced single-wall nanotube typically has close-ends, as illustrated on the right, with a diameter of 1-2 nm and length of ~10 micron.

Properties of Carbon Nanotubes:

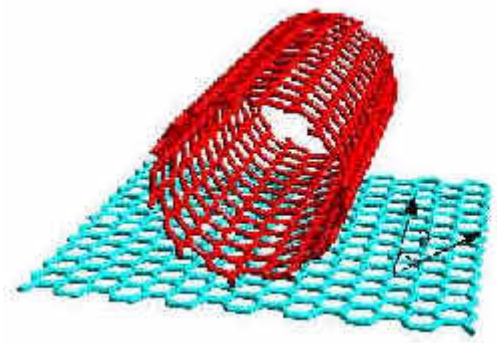
Recent research has shown that carbon nanotubes have promising materials properties for technological applications. For examples carbon nanotubes have:

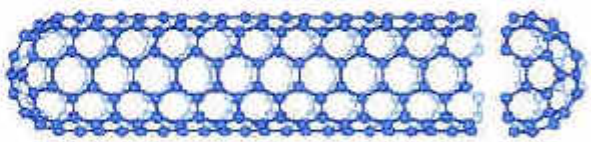
- the highest elastic module, and mechanical strength that is approximately 200 times stronger than steel.
- novel electronic properties.
- high thermal conductivity.
- excellent chemical and thermal stability.
- promising electron field emission properties.
- high chemical (such as lithium) storage capacity.

Applications of Carbon Nanotubes:

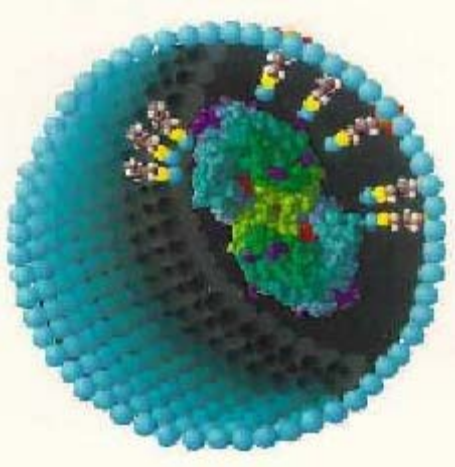
Because of their excellent properties, carbon nanotubes are useful in a broad range of technologies such as:

- Telecommunication, cell phones.
- Rechargeable lithium batteries.
- Medical image equipment.
- Computer display.
- Multi-functional composites for aircraft.
- Electron beam
- Medical treatment as following:

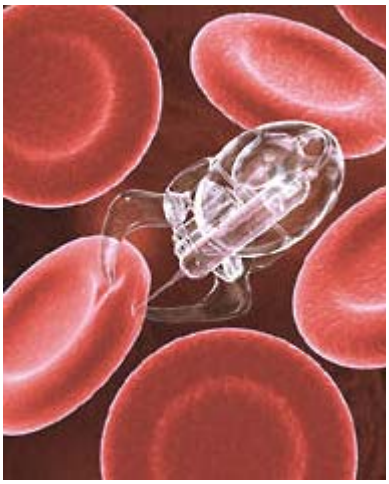




Nanomedicine is the preservation and improvement of human health using molecular tools and molecular knowledge of the human body. Nanomedicine will employ molecular machine systems to address medical problems.Cells have been shown to grow on CNTs, so they appear to have no toxic effect. The cells also do not adhere to the CNTs. The ability to functionalize (chemically modify) the sidewalls of CNTs also leads to biomedical applications such as vascular stents, and neuron growth and regeneration. It has also been shown that a single strand of DNA can be bonded to a nanotube, which can then be successfully inserted into a cell. Nanomedicine will employ molecular machine systems to address medical problems, and will use molecular knowledge to maintain and improve human health at the molecular scale.

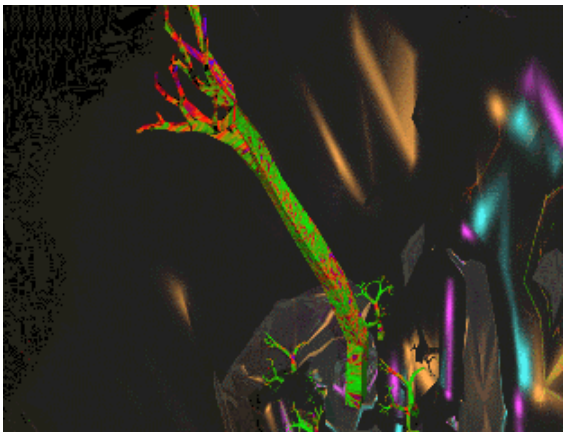


Some future nanotechnology medical product ideas

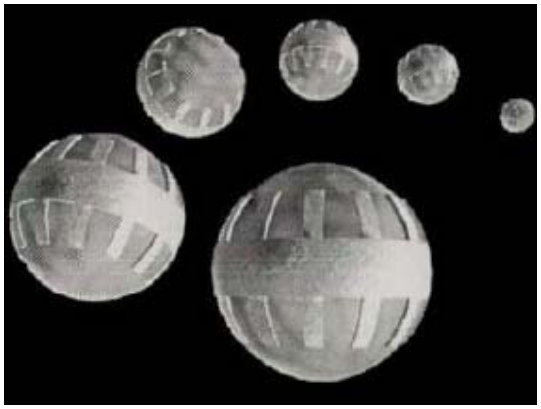


One major future application of nanotechnology may be the targeted delivery of drugs to specific organs or tissues e.g. for the treatment of cancers at their site rather than the use of systemic and often highly toxic chemotherapy. Another possible application could be the delivery to specific sites of coated nanoparticles that could then be heated using intense light thereby destroying diseased tissue and cells.

Vastly reduced component sizes resulting from nanoengineering could enable complete surgical robots or miniature medical devices to be constructed. The picture on above is a representation of a drug delivery nanodevice.



Nanotechnology also offers considerable promise in the rapidly-developing field of human tissue engineering. At above there is an engineered human nerve cell utilizing a matrix formed of an nanoengineered biodegradable biopolymer.



For example, "respirocytes" like those depicted here could augment oxygen supply to poorly vascularized tissues. Measuring 1 micron it has been suggested that these could pump 236 times more oxygen to tissue than a red blood cell.

They could also include an onboard nanocomputer and chemical and pressure sensors.

Nanotechnology will prompt the medicine to remove obstruction in the circulatory system, kill cancer cells, or take over the function of sub cellular organelles. Killing viruses or bacteria, dissolving cholesterol or blood clots. Discovering the earliest signs of the diseases, even before the actual symptoms appear. Nanotechnology will be able to produce hearing aids that are actually a computer in each ear, artificial retinas to restore sight and many other medical wonders. Some of these will come within the next ten years. Nanotechnology would allow the gene combinations take place at the levels of molecules, rather than the larger gene. That would mean creating whole new organs for people, organs which their bodies won't reject as they do with transplanted human organs.

Nanotechnology will have made some possible spectacular breakthrough in medical research and diagnostic in addition to innovation to other fields.

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