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Nanotechnology: Its impact on human life

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ABSTRACT

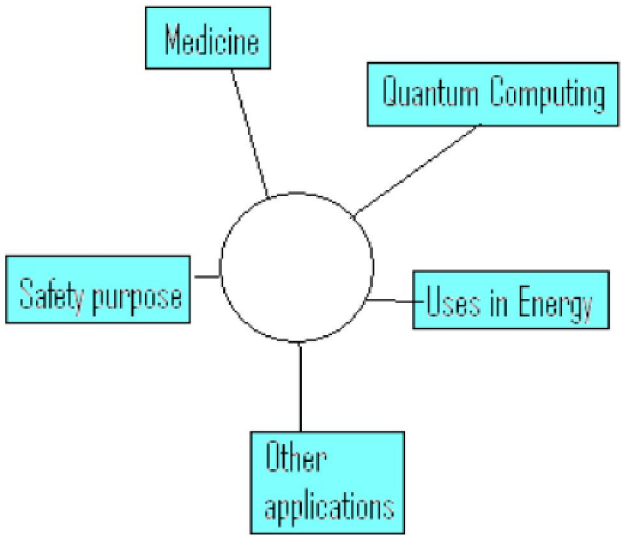
Nanotechnology as a scientific and technological thrust enunciates the best of many opportunities afforded to the Engineering, Scientific and Industrial Communities. The scientific opportunities seem to be considerable, industrial interest is superb and the social benefits are significant from new materials and new products applicable to information technology, medicine, energy and the environment. Nanotechnology with advancement of production of new nanomaterials opens an entirely new era for scientific innovations which will have great impact on human life.

In the prehistoric age of man's life on earth, the materials that were available to him were mainly stone, wood, bone and skin which he learnt to fashion for his use. It is interesting to note that these materials evolved and devised by nature and then by man have provided the insights and models for the design of modern materials.

USE OF NANOTECHNOLOGY IN MEDICINE

Scientific activities in the field of drug development are as much governed by the state of the art of the times as any other field. These will be replaced by nanotechiques as time goes by computer assisted drug design is no doubt the latest approach, but not the only approach to drug development and cannot still boast of many successes.

Nanotechnology has its biggest impact on medical industry for instance diseases are caused largely by damage at the molecular and cellular level; today's surgical tools are at this scale large and crude whereas Nan robots could be programmed to perform delicate surgeries and nano surgeons could work at a level thousand times more precisely than the sharpest scalpel available today. Scientists are also thinking of making mechanical fluid containing robots that could attack viruses and reconstruct the molecular structure of cancer cells[1,2].



Scientists are trying to link together technologies from a variety of scientific disciplines like scanning probe microscopy, biosensors, optical imaging and theory. Materials are being developed that drive and maintain required and appropriate cellular and tissue responses and

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uses them for the replacement of degenerate ing and diseased organs and tissues. Smart biomaterials are expected in near future for medical and other applications. Novel nanomaterials are being developed for cancer therapy, active drug delivery etc. We can see that nanotechnology can change the destiny of nations and human race. Also, Artificial Intellligence base Universal Operating System for Novel Smart Discovery is being envisaged.

No doubt, the country should have laboratories and interdisciplinary teams to carry out new drug development. One should also not underestimate the demands that new drug development will make in terms of men, money and materials.

QUANTUM COMPUTING

Nanotechnology has completely changed the scenario in the world of miniaturization of electronic components. Semiconductors like Ge and Si are the building blocks of electronic devices. They are not versatile and the chip constructed using traditional semiconductors cannot be shrunk beyond limit. This is because of their classical behaviour. Now, with the advent of nanotechnology, their quantum behaviour has become important. We talk about quantum information processing, quantum computing, quantum cryptography etc.

Quantum computing is being hectically pursued by experimentalists and theorists. As one knows that if we consider the classical behaviour of semiconductors, their optical and electronic qualities are difficult to control since their band gap cannot be easily adjusted. As their bandgaps cannot be tuned to the requirements, emission frequencies are beyond adjustment.

Quantum dots will be the futuristic semiconductors. As anyone can understand, 2-Dimensional quantum confinement of electron and hole is 2-D quantum gas. Restriction of 1-D movement of electron gas is 1-D quantum wire. No movement of electron suggests 0-D quantum confinement which is known as quantum dot which is also known is q-bit in digital electronics. The spin of electron in two opposite directions can be considered as 0 & 1 state. This 0,1 state of quantum dot system has been tried to be used in quantum computer. In order to produce a quantum dot, the matter is etched i.e. top to bottom approach is used. Electron device that intends to deal with quantization of electronic charge in tunnel effect is known as single electron device. Such will be the impact of nanotechnology on computing and mobile phone revolution.

OTHER APPLICATIONS

The miniature size and versatile properties of quantum dots grant them the flexibility to be used for a variety of applications. Quantum dots can be tuned to emit sharp visible or infrared wavelengths. This increases their fluorescent lifetime. This can be used in televisions. Quantum dots colloids float freely and can be attached to a variety of molecules like amine, phosphine, carboxylic acid etc. which permits them to be used in variety of applications such as special inks, dyes or paints. Doping polymers or glass materials with quantum dots will help improve optical characteristics. Quantum dots can be fashioned into tiny beads that emit infrared radiations. These pre-specified and pre-tuned radiations can serve as a versatile trespasser tracking indicator by adhering to the person. Thus nanotechnology will serve the security and military communities in the years to come[3].

To safeguard against health hazards, the scientists and technologists are making efforts to develop superconducting wires (materials exhibiting zero resistance). But even after a long period of research, the success towards superconductors at room temperature has eluded them so far. Scientists have not lost hope and are now trying to make low-cost, light-weight wires with minimal resistance termed as 'quantum wires' – about which we talked above. Prof. Rafael de Picciotto et. al. at Bell labs, USA, has shown for the first time that resistance vanishes in small but perfectly formed 'quantum wires' because these tiny structures are almost free of defects. A nanotube is a clear plastic tube that holds a thin, dark grey fibre and about 15 cm length of the fibre comprises of billions of carbon nanotubes in a macroscopic system. Based on bias-dependent imaging studies in a scanning tunneling microscope, Zhang and Lieber suggest that nanotubes are semiconducting[4].

Discovered in 1991, carbon nanotubes are tiny, molecular cylinders formed purely of carbon atoms. They are created by shooting high powered lasers at a car-

bon target. They can also be produced by arc by large electronic field in plasma. It has been possible to selectively burn tube tips and to strip the outer layers[5,6].

The oxidative opening of the nanotube tips allows molten metal to be drawn in through capillary action. Transition metals such as Fe and Co act as catalyst in the growth of single layer tubes[7]. Some futuristic applications of applications

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