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# ROLE OF NANOTECHNOLOGY IN SOCIAL WELFARE

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**RESEARCH PAPER IN ZOOLOGY**

***Abstract:***

*The main objective of this review is to study of nanotechnology in different and recent science and engineering sectors. Nanomaterials are at the leading edge of the rapidly developing field of nanotechnology. The focus on applications to information processing, energyand health implies that these are the areas in which the greatest impact is foreseen.Their unique size-dependent properties make these materials superior and indispensable in many areas of human activity. The most recent developments in the field of applied nanomaterials, in particular their application in biology and medicine, and discusses their commercialisation prospects. The realisation that the nanoscale has certain properties needed to solve important medical challenges and cater to unmet medical needs is driving nanomedical research. The present review explores the significance of nanoscience and latest nanotechnologies for human health.*

***Keywords****: nanotechnology, nanomaterials, nanoparticles, medicine, biology, applications.*

**Introduction**

Nanotechnology refers to the branch of science and engineering devoted to designing, producing, and using structures, devices, and systems by manipulating atoms and molecules at nanoscale, i.e. having one or more dimensions of the order of 100 nanometres (100 millionth of a millimetre) or less.

The potential impact of nanotechnology stems directly from the spatial and temporal scales being considered: materials and devices engineered at the nanometer scale implycontrolled manipulation of individual constituent molecules and atoms in how they are arranged to form the bulk macroscopic substrate. This, in turn, means that nanoengineered substratescan be designed to exhibit very specific and controlled bulk chemical and physical properties as a result of the control over their molecular synthesis and assembly. It is expected that nanotechnology will be developed at several levels: materials, devices and systems. Living organisms are built of cells that are typically 10 μm across. However, the cell parts are much smaller and are in the sub-micron size domain. Even smaller are the proteins with a typical size of just 5 nm, which is comparable with the dimensions of smallest manmade nanoparticles. This simple size comparison gives an idea of using nanoparticles as very small probes that would allow us to spy at the cellular machinery without introducing too much interference . Understanding of biological processes on the nanoscale level is a strong driving force behind development of nanotechnology .

Many of the applications of nanotechnology involve new materials that have very differentproperties and new effects compared to the same materials made at larger sizes. This is due to the very high surface to volume ratio of nanoparticles compared to larger particles, and toeffects that appear at that small scale but are not observed at larger scales.

The applications of nanotechnology can be very beneficial and have the potential to make a significant impact on society. Nanotechnology has already been embraced by industrial sectors, such as the information and communications sectors, but is also used in food technology, energy technology, as well as in some medical products and medicines. Nanomaterials may also offer new opportunities for the reduction of environmental pollution.

**Utiization** :

A list of some of the applications of nanomaterials to biology or medicine is given below:

- Fluorescent biological labels
- Drug and gene delivery
- Bio detection of pathogens
- Detection of proteins
- Probing of DNA structure
- Tissue engineering
- Tumour destruction via heating (hyperthermia)
- Separation and purification of biological molecules and cells
- MRI contrast enhancement
- Phagokinetic studies

As mentioned above, the fact that nanoparticles exist in the same size domain as proteins makes nanomaterials suitable for bio tagging or labelling. However, size is just one of many characteristics of nanoparticles that itself is rarely sufficient if one is to use nanoparticles as biological tags. In order to interact with biological target, a biological or molecular coating or layer acting as a bioinorganic interface should be attached to the nanoparticle. Invisible particlesthat fight cancer cells, faster microprocessors that consume less energy, batteries that last 10 times longer or solar panels that yield twice as much energy. These are just some of the many applications of nanotechnology, a discipline with all the ingredients to turn into the next industrialrevolution.

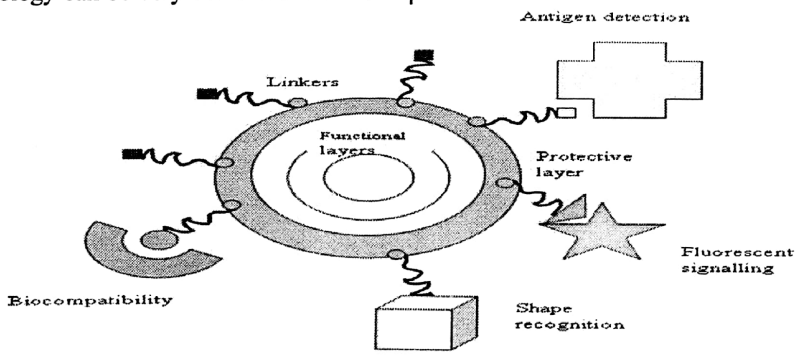


**Fig :Typical configurations utilised in nano-bio materials applied to medical or biologicalproblems.**

Nano-particle usually forms the core of nano-biomaterial. This helps with creating biomarkers with many and well distinguished colours. The core itself might have several layers and be multifunctional. For example, combining magnetic and luminescent layers one can both detect and manipulate the particles.

**The Significance of Nanotechnology Education in Modern Society**

As a result of the importance of nanotechnology, the countries of the world in general and the developed world, in particular, have been very interested in nanotechnology and they think to introduce the leading nanotechnology in the field of teaching and learning.

Nanotechnology topped the list of scientific and research interests in most countries of the world.Many countries during the past few years established programs and research units, academic and research institutes but the steady growth of nanotechnology is a challenge for the scientific community interested in universities and technical

colleges to prepare the workforce to provide future career opportunities in this field.

**Cancer therapy**

Photodynamic cancer therapy is based on the destruction of the cancer cells by laser generated atomic oxygen, which is cytotoxic. A greater quantity of a special dye that is used to generate the atomic oxygen is taken in by the cancer cells when compared with a healthy tissue. Hence, only the cancer cells are destroyed then exposed to a laser radiation. Unfortunately, the remaining dye molecules migrate to the skin and the eyes and make the patient very sensitive to the daylight exposure. This effect can last for up to six weeks.

**Multicolour optical coding for biological assays**

The ever increasing research in proteomics and genomic generates escalating numberof sequence data and requires development of high throughput screening technologies. Realistically, various array technologies that are currently used in parallel analysis are likely to reach saturation when a number of array elements exceed several millions. A three-dimensional approach, based on optical "bar coding" of polymer particles in solution, is limited only by the number of unique tags one can reliably produce and detect.

**Manipulation of cells and biomolecules**

Functionalised magnetic nanoparticles have found many applications including cell separation and probing; these and other applications are discussed in a recent review [8]. Most of the magnetic particles studied so far are spherical, which somewhat limits the possibilities to make these nanoparticles multifunctional. Alternative cylindrically shaped nanoparticles can be created by employing metal electrodeposition into nanoporous alumina template .Depending on the properties of the template, nanocylinder radius can be selected in the range of 5 to 500 nm while their length can be as big as 60 μm. By sequentially depositing various thicknesses of different metals, the structure and the magnetic properties of individual cylinders can be tuned widely.

**Protein detection**

Proteins are the important part of the cell's language, machinery and structure, and understanding their functionalities is extremely important for further progress in human well being. Gold nanoparticles are widely used in immunohistochemistry to identify protein-protein interaction. However, the multiple simultaneous detection capabilities of this technique are fairly limited. Surface-enhanced Raman scattering spectroscopy is a well-established technique for detection and identification of single dye molecules. By combining both methods in a single nanoparticle probe one can drastically improve the multiplexing capabilities of protein probes. The group of Prof. Mirkin has designed a sophisticated multifunctional probe that is built arounda 13 nm gold nanoparticle.

**Commercial exploration**

Some of the companies that are involved in the development and commercialisation of nanomaterials in biological and medical applications. The majority of the companies are small recent spinouts of various research institutions. Although not exhausting, this is a representativeselection reflecting current industrial trends. Most of the companies are developing pharmaceutical applications, mainly for drug delivery.

**Future directions**

As it stands now, the majority of commercial nanoparticle applications in medicine are geared towards drug delivery. In biosciences, nanoparticles are replacing organic dyes in the applications that require high photo-stability as well as high multiplexing capabilities. There are some developments in directing and remotely controlling the functions of nano-probes, for example driving magnetic nanoparticles to the tumour and then making them either to release the drug load or just heating them in order to destroy the surrounding tissue. The major trend in further development of nanomaterials is to make them multifunctional and controllable by external signals or by local environment thus essentially turning them into nano-devices.

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