



# Nanotechnology in Health Care

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**Abstract:** Nanotechnology deals with the behavior and manipulation of individual atoms and molecules whose size is less than 100 nanometers of a human genome. The breakthrough work was announced in 1981 for the invention of scanning tunneling microscope and the discovery of nanocrystalline. Today's scenario in nanotechnology is astounding as it has been integrated in many forms such as Nano agriculture, energy storage, water treatment and many more. Nanotechnology in the field health care offers even a wider extent of applications such as nanotubes, stretchable electronics and bleeding plastic. Nano medicine is the application of Nano technology to human health care by which the medical diagnosis of a patient and the relevant treatment can be efficiently managed. Another important parallel study about nanotechnology is the regeneration of organs and tissues. A large range of deadly diseases such as Alzheimer's, cardio vascular diseases, neurological diseases can be treated very effectively and efficiently. The present work emphasizes on the study of concept of nanotechnology and its wide variety of applications with a case study.

**Keywords:** Nano technology, nano tubes, bleeding plastic, genome, Nano medicene.

## I. INTRODUCTION

The Current trend in nanotechnology has seen a major growth in the field of chemistry and medicine. This is due to new materials which have been synthesized and implemented in Molecular Genetics, Biology, Chemical Engineering and Biochemistry. Nanotechnology is basically the study of extremely tiny particles and how they can be applied in various fields such as biology, chemistry and medicine. To give an idea of how small these particles are, the thickness of a sheet of paper is 100,000 nanometers and a single strand of human hair is about 60-80,000 nanometers wide. The latest breakthrough in nanotechnology has surpassed expectations giving a whole new meaning, like for instance Spanish and Australian scientists have developed a Nano material using black silicon with tiny spokes on its surface, this specific material doesn't allow the growth of bacteria on it, and their inspiration? The structured wings of an Australian dragonfly called the "wandering percher".[7] Another one of these breakthroughs is that a group of researchers from Harvard University have come up with a way to 3-D print batteries which are 1mm in length. The material could also be molded into layers precisely giving working anodes and cathodes. The Field of Nano medicine also has seen major breakthroughs both in the field of human genome and diseases, few of the cases are nanotubes are genome sequences which are in the form of human genome rolled in a 2-D shape or different shapes as well. These nanotubes can deliver drugs to the affected group of cells, for instance Fig. 3. Shows cancer cells being treated [6]. Their target organs or cells is very specific and they are activated only in the presence of a specific molecule, this ensures the effectiveness of the drug delivery and the exact amount of drug is delivered these have prospective

applications to treat cancer in the near future which has been depicted in Fig. 4.. Nanotechnology can also be used to treat heart diseases such defective heart valves and arterial plaque, also plays a key role in finding people who have a higher risk of heart diseases. Nanotechnology can not only detect heart attacks but it can also prevent them. The heart surgeries which are performed are usually invasive in nature but nanotechnology offers a better alternative which reduces the risks in heart surgeries and increases the success rate. Nanotechnology has given birth to another field called Nano robotics. Nano robotics is nothing but the technology used to create robots which are in the scale of nanometers. Nanorobotics have found a wide range of application especially in the field of medicine for example nanorobotics increase the probability of detecting and monitoring life threatening diseases like brain aneurysms, cancer, chronic diseases. Intravascular Nano robots would constantly monitor and provide current information of the status of such diseases hence any abnormal or undesired activity can be caught at the earliest.

Nanorobotics can also be used in human surgeries these are inserted into the human body through vascular systems or other cavities. These Nano robots are either pre-programmed or are being monitored by a human surgeon. These surgical Nano robots have functionalities like correction and diagnosis of lesions, identification of pathogens. Ease of Use[7]

## II. PRILIMINARIES

This section provides information about Nano particles in the field of health care.



**A. DNA Manipulation**

Advancements in nanotechnology has helped in fabrication of new nanomaterial which have enabled for the development of highly sensitive and specific sensors which involve the manipulation of individual genome. The integration of these Nano sensors helps the therapists to diagnose and treat the disease in early stages.

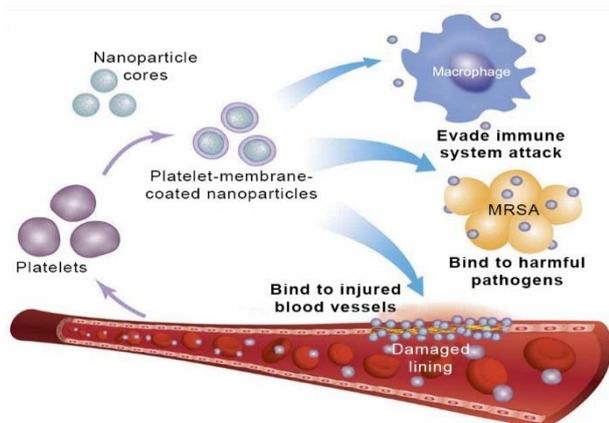


Fig. 1. Nano Particles

**B. Nano rods**

Nano rods are the most widely used Nano materials[2]. Gold Nano rods are often used in detection for biological sensing applications. Biomedical applications of Nanoparticles require Nano rods which bind with biological molecules such as antibodies have been shown in Fig. 1.

**C. Nano tubes or carbon nanotubes (CNT)**

They smaller than a human hair and have extraordinary properties like flexibility, strength and semiconducting properties[2]. These Nano tubes act as Composite fibers in polymers to improve the mechanical, thermal and electrical properties

**D. Nano capsule**

Nano Capsules are used for dressing the wound that is coated with Nano capsules containing antibiotics. If the wound cases harmful bacteria Nano capsules will break open realizing antibiotic. Nano capsules which are dissolvable in water are used to treat cancer which helps to deliver a protein to the cancer cells [3].

**E. Nanoparticle Cream**

Is one of the best inventions in Nano technology contains nitric oxide gas, when applied in the site of infection, targets the source of the infection and destroys them. These are also called as killers of bacteria.

**III. CASE STUDY: DRUG DELIVERY SYSTEM**

Nanotechnology can be used in a very efficient Drug Delivery System. The traditional Drug and gene delivery

has quite a few problems and in order to overcome this nanoparticles are being used. The building block of an efficient drug delivery system is the interaction between the biological components and the Nano materials, these nanoparticles are directly involved on a cellular level. Various cancer drugs like paclitaxel doxorubicin and dexamethasone have been successfully synthesized using nanotechnology [3].

The diagnosis and detection of brain cancer is one of the most difficult challenges because of penetration beyond the blood brain barrier and into the brain. In order to cross the blood brain barrier anticancer drugs like doxorubicin have been shown to cross the blood-brain barrier and hence targeting the affected cells of the brain. The nanoparticles used in Drug Delivery are usually less than hundred Nano Meter in at least one dimension they are usually made of biodegradable materials like natural or synthetic polymers, lipids [1].

**Drug Delivery System**

A drug being delivered in a conventional Drug Delivery System depends majorly on two factors one is the site at which the drug is being delivered and the interaction between the drug and the biological environment outside [4].

Nanoparticles can be used when drug delivery needs to be at a very specific site and needs to improve the solubility of the drugs being delivered.

For instance let us take the drug dexamethasone it is a drug that has anti-inflammatory and anti-proliferative effects. The drug binds with the cell forming a complex genome which is transported to the affected group of cells [3].

The use of liposomes, Micelles which are colloidal modalities have been extensively used in research Cancer therapy. The efficiency of any Drug Delivery System can be analyzed by their size, less drug toxicity, timing of release of the drug, biological interactions and the site of

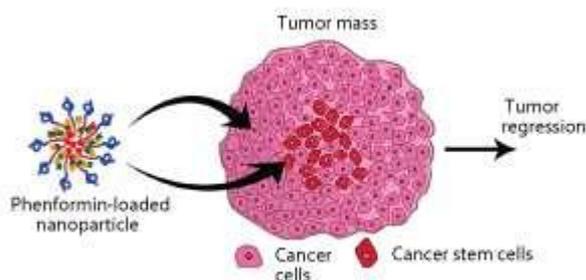


Fig. 2. Targeted Drug Delivery

Delivery. Cancer treatment chemotherapy can sometimes be redundant as the tumor cells overtime develop resistance to the drugs being used for the treatment as shown in Fig. 2. this is usually due to the growth of a certain protein called p-glycoprotein, this protein has the



capability to remove the drug out of a cell as soon as it crosses the cells exterior membrane nanotechnology has shown a promising probability that the nanoparticles which are being used as anticancer drugs can enter the cells exterior membrane without activating the p-glycoprotein [3].

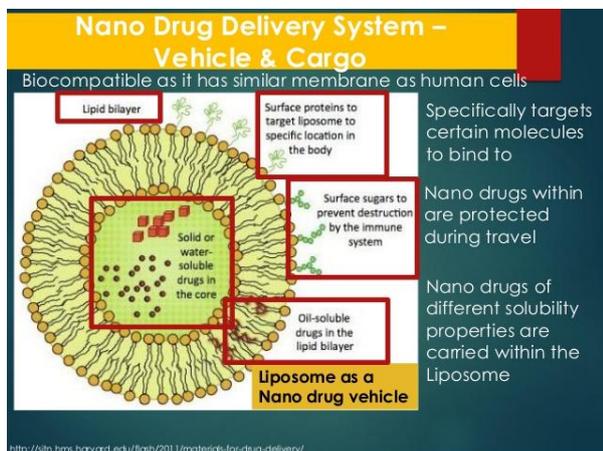


Fig. 4. Nano drug delivery system

### Cancer Treatment Using Nano Medicine

Cancer is one of the most difficult disease to diagnose and treat in today's scenario. Brain cancer, especially is one of the most difficult ones to trace and treat because of various factors like difficulty in getting a brain image, barriers that need to overcome in order to deliver the drug across the blood brain barrier. Quite recent studies has found that nanoparticles can deliver drugs in to the brain. Kopelman and colleagues designed probes encapsulated by biologically localized embedding (PEBBLE). The Pebble is a carrier of a range of differently abled agents on the surface which can perform multiple functions for example One Target molecule present on the surface can enable the PEBBLE to the path of a tumor and other molecules can enhance the Magnetic resonance imaging which helps in getting a better visualization of the target while another agent can deliver the prescribed drug dosage to the infected cancerous cells all these three functions are integrated into one minuscule Polymer which makes it an efficient treatment against cancer [1].

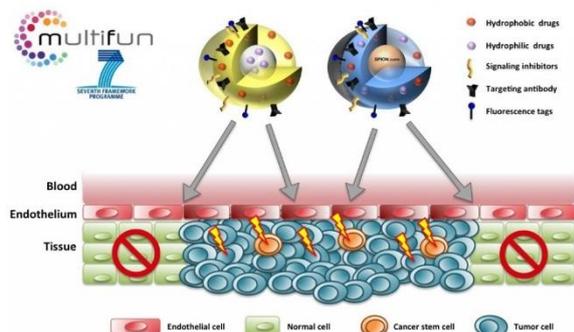


Fig. 3. Nano technology in cancer treatment

### IV. CONCLUSION

Nanotechnology when integrated in the field of health care, opens up a whole new dimension of approaching and treating a disease. This has proved to be very effective and efficient. Nano medicine can soon replace conventional approaches which we take to diagnose, detect and treat diseases. Nano medicine in current day is producing ground breaking work and shows a promise in the very near future in providing solution to even diseases that are to be thought incurable.

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