# Nano-medicine in General medicine


## Abstract

Nanotechnology has emerged as a high-potential technical field because it should be utilized in practically almost every situation of recent life. Medical research is one among the fields where nanotechnologies predicted to play a vital role. The fusion of nanotechnology and medicine has given rise to a brand-new scientific subject referred to as nanomedicine. Nanomedicine may be a field that strives to improvise person's well-being in every possible manner and imaginable by utilising nanotechnology techniques and principles. In terms of observations , diagnostic, bioanalysis, and imaging, nanotechnology offers monitoring tools and technology platforms. The National Institutes of Health has coined the term "nanomedicine" to explain the applying of nanotechnology to biological systems for diagnosis, treatment, evaluating, and control. Cancers (tumour cells, similarly as tumour neo-vasculature) are mononuclear phagocytes, dendritic cells, endothelial cells, and cancers (tumour cells, yet as tumour neo-vasculature). Presently, nanotechnology plus nanoscience methods to particle design and formulation are setting out to extend the marketplace for many pharmaceuticals and are laying the groundwork for a lucrative niche within the business, but a number of the anticipated benefits are exaggerated. The focus of this work is on nanoscale vehicle and entity design, yet as surface engineering, for site-specific drug delivery and medical imaging after parenteral administration. The potential hazards and negative effects of nanoparticles are explored. These particles are at the forefront of nanotechnology's fast-paced development. These materials ought to be excellent and indispensable in many human activities owing to their idiosyncratic size-dependent characteristics. This brief study attempts to summarize current discoveries in the field of applied nanomaterials, with a focus on their use in biology and medicine, as well as their commercialization potential.


**Keywords:** Nano-medicine, Nanotechnology, Biological systems, Diagnosis, Treatment.

## INTRODUCTION

Nanotechnology may be a broad term that refers to a spread of how for creating things smaller than 100 nanometers. Nanomaterials are employed in biological and medical research for a range of purposes (e.g., contrast agents for ct scans). This hybrid field is brought up by terms like biomedical nanotechnology, bionanotechnology, and nanomedicine. Interfacing nanomaterials with biological molecules or structures can provide functionality to them. Nanomaterials are often employed in biomedical research and applications both in vivo and in vitro. Diagnostic gadgets, contrast agents, inquisitive instruments, physical therapy applications, and drug-delivery vehicles have all been developed as a results of the mixture of nanomaterials and biology. Nanotechnology is considered a developing technology since it allows for the advancement of existing products also because the creation of latest products with entirely new characteristics and functions, all of which have immense promise during a big selection of applications. Aside from many industrial applications, significant advancements are expected in intelligence biology and biotechnology, medicine and medical technology, metrology and information and communication technology with other fields. Nanotechnology is predicted to possess a major positive impact on human health. [1] The fundamental biological units like DNA, proteins, and cell membranes all exist at the nanometre scale, which is where the relevant processes of living creatures occur.

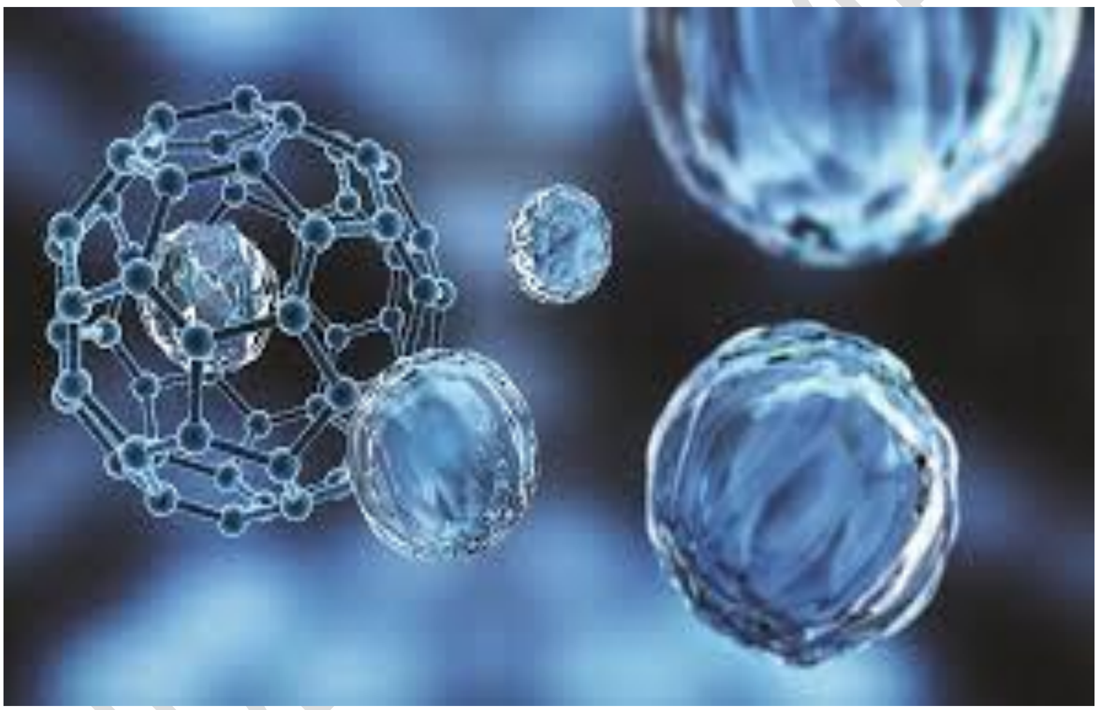

FIG 1. Nanotechnology

Nanotechnology, Biotechnology, Information Technology, and scientific discipline - NBIC advancements — have huge aspirations in modern health. Investigations (disease detection and scanning), evaluation, the provision more resilient plus better prostheses, and novel drug delivering for potentially toxic substances are just a few of the medical applications that could be developed. Nanoscale diagnostics, as an example, could be ready to detect disease within the early stages, allowing doctors to intervene before symptoms appear.

One of the most recent technologies is Nanotechnology.Many countries, including India, are within the process of reorganising their economies. it's predicted that various new technologies would emerge during the following 5 years approximately. Nanomedicine-based solutions are expected to hit the market within the near future.

As a result, determining the extent becomes necessary. Nanomedicine could be a field where there's plenty of innovation. However, India currently lacks in such invention. This report aims to produce an outline of the state of nanomedicine research and innovation in India. this study assesses innovation using five criteria: the financial ecosystem, technological resource, research translation, bibliographic data (patents and publications), and legislation. The study also discusses public-private alliance and international thereabouts . The landscape describes the present state of nanomedicine in India I and will be useful in policy discussions.

Medical history portrays a lengthy, arduous fight to higher human health, a battle that may eventually lead to an excellent victory: the abolition of disease and misery within the twenty-first century. Predicting that almost approximately 10 billion individuals who have anytime lived a median of forty years and expense mere 2% of their lives in sorrow and disease, an not insignificant amount of 70 trillion human misery in human-hours was paid to achieve this aim.[2]

## METHODOLOGY

The type of research i'm conducting is Narrative Review Article.
I have collected My articles for review from Pubmed and Google scholar.
Records obtained through pubmed database searching by searching of MESH words like - Nanomedicine generally medicine
There were around 859 Articles.
Records identified after exclusions by considering criteria like Full text availability, free full text and full text, English and Only Systemic article and Review there have been around 120 articles.
We narrowed it right down to 51 articles by considering articles only from last 5 years.
Out of this 51 articles Only 8 articles were taken for research review.
Additional data was obtained from google scholar and Davidson textbook of medication.

## DISCUSSION:

Nanotechnology has ushered in an exceedingly new era in medicine (nano-medicine). Application of nanotechnology in medicine contains a whole bulk of potential. Some approach are simply an idea, while different pole are in different phases of development or are now in work. In nanotechnology, there are two main approaches: one may be a "bottom-up" approach, within which materials and devices are built up atom by atom, and also the other could be a "top-down" approach, within which materials and devices are synthesised or constructed by removing existing material from larger entities. [3]

Nanotechnology in medicine includes both short-term research involving the utilization of manufactured nano-robots to repair cells and longer-term involving the manufactured nano robots(mentioned as nano-medicine).

The notion of nanotechnology-on-achip is an extension of lab-on-achip.

When specific nanoscale particles are used as tags or labels, biological tests evaluating the presence or activity of certain substances become faster, more sensitive, and more adaptive.

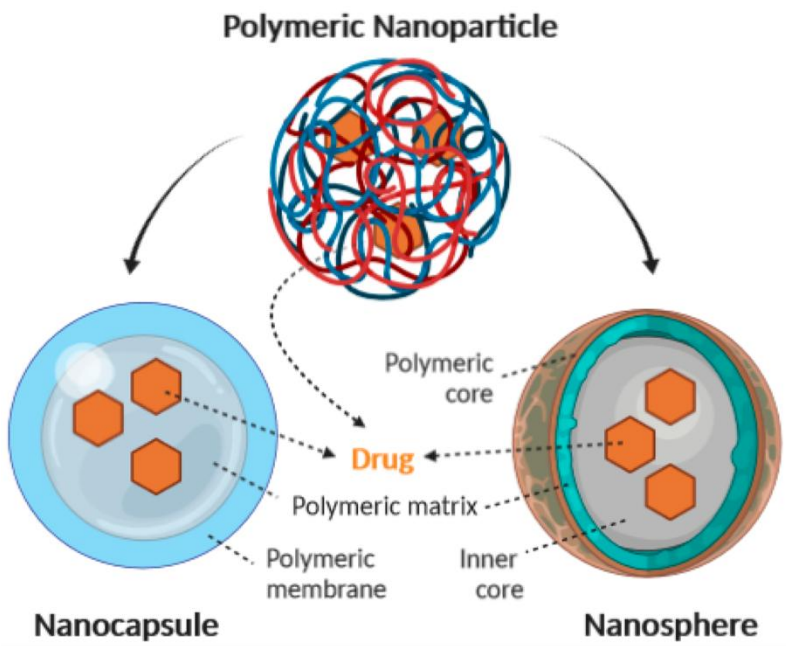


FIG 2. Nanocapsule and Nanosphere

By depositing the present medication solely within the morbid area and at no greater dose than required, overall drug consumption and adverse effects will be greatly reduced.

Tissue engineering could be a technique that uses nano-material-based scaffolds and growth agents to accelerate cell proliferation artificially. Tissue engineering has the potential to exchange current treatments like organ transplants and artificial implants. Nanoparticles can enter the body through four different routes: inhalation, swallowing, skin absorption, and injection during medical operations (or released from implants). They're very mobile once inside the body, and that they can even breach the barrier in some cases.[4]

Tissue engineering combines engineering and biological science ideas and discoveries to improve, restore, or replace tissue/organ function. The basic notion of merging cell, scaffold (artificial extracellular matrix), and bioreactor technologies in the design and manufacture of neo-tissues/organs has controlled this multidisciplinary discipline since its start.

every tissue and organ in our body is made up of parenchymal aka functional and mesenchymal aka support cells that are trapped inside.

These microenvironments are what make up our tissues and organs, and they are formed by an extracellular matrix.

Our bodies serve as bioreactors for the formation and maintenance of tissues and organs, introducing the cell micronenvironment matrix to biomechanical pressures and biochemical signals.[5]

Nanomedicine, which works at the molecular level, is enlivened by promises of soothing integration of biological and technology, disease eradication through personalised medicine, targeted medication delivery, regenerative treatment, and nanomachinery that can replace parts of cells.

Although many of these aspirations might not come to realisation, few nanomedicine applications have become reality, with the potential to dramatically revolutionise medical practise as well as current understandings of health, disease, and biology— issues that are critical to modern civilizations.Due to technical improvements, the field's global marketingsharing reached $78 billion in 2012.The market is predicted to rise to about $200 billi on by the end of the decade.

**Types of nanoparticles**

Metals whose properties are drastically altered at the nanoscale are commonly found in these particles. Due to their ability to soak up certain wavelengths of radiation, gold "nanoshells" are useful within the battle against cancer, especially soft-tissue cancers. When nanoshells enter tumour cells and are exposed to radiation, they absorb the energy and warmth up sufficiently to destroy cancerous cells. Silver nanoparticles with a charge bind to single-stranded DNA and might be accustomed detect it.
Many more techniques and equipment are being developed for in vivo imaging ( fluorescence detecting systems) yet on ameliorate disparity in ultrasound and MRI pictures.

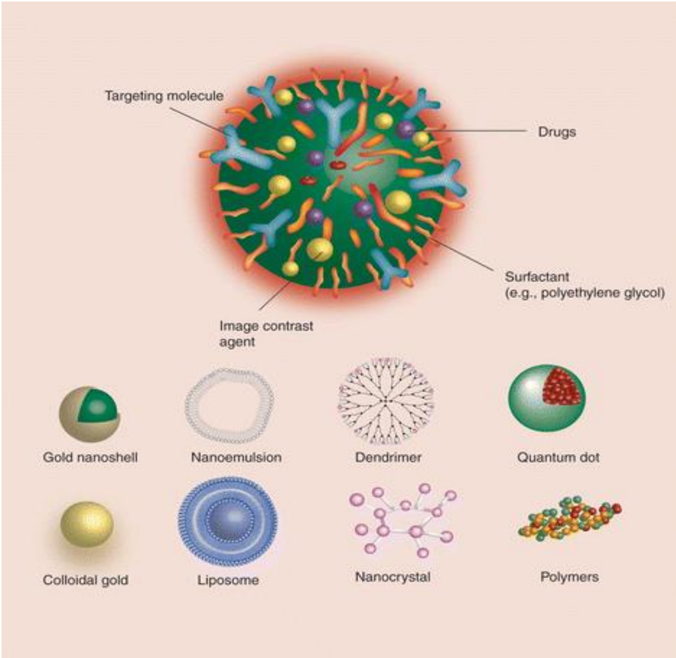


FIG 3. Different types of nanoparticles

Applications of nanotechnology:
1. Diagnostics
2. Therapeutic or pharmaceutical
3. Surgery

Nanoparticles made of carbon

Carbon Nanotubes (CNTs) and fullerenes are the two different types of carbon-based nanoparticle known:
Carbon nanotubes (CNTs) are graphene sheets wrapped into a tube.Because these materials are 100 times stronger than steel, they are primarily employed for structural reinforcement. Single-walled carbon nanotubes (SWCNTs) and multi-walled carbon nanotubes (MWCNNTs) are two types of carbon nanotubes (MWCNTs). CNTs are unusual in that they are thermally conductive along their length but not across their width. Fullerenes are carbon allotropes with a hollow cage structure containing sixty or mor carbon atoms.Buckminsterfullerene is the name forC60's structure, which resembles a hollow football. These structures have a pentagonal and hexagonal arrangement of carbon units.Because of their electrical conductivity,construction ,high strength, and electron affinitythey have commercial applications. [6]

**Nanoparticles made up of ceramics**:

Ceramic nano-particles are made up of carbides, carbonates oxides and phosphates and are inorganic solids. These nanoparticles have a high surface area.

## Diagnostics

Nanostructures are aids to nanodiagnosis The nanostructure dimensions help for instance the scale target which biomolecules like macromolecule, proteins, and viruses exist at the nanoscale. the employment of fabric to detect biochemical changes, activity, and concentration of a selected substance in biological solution is thought as in vitro diagnostics. [6] Such biochemical changes also can be detected and converted into a biochemical signal by one biosensor or an integrated system combining multiple biosensors. Nanosensors' small size and low cost will make acquiring this information possible for the primary time, even in routine diagnosis. It becomes feasible to identify problems considerably early with concurrent monitoring of a patient's systems, with a more aggressive & exploratory therapy strategy. Thousands of clinical tests are going to be rolled into one low-cost hand-held device. As a result, diagnosis are going to be considerably more dependable, increasing accuracy while lowering malpractice/insurance liability.

Therapeutic and pharmaceutical uses
Nanotechnology compass around type of fields like drugs and therapeutics. Nanotechnology allows medicine or pharmaceuticals to be delivered to specific sections of the bod, rendering them even more practical and fewer hazardous to other parts of the body. Gold nanoparticles with anti-cancer properties are discovered to be quite effective. thanks to their capability to soak up radiation at specific wavelengths, gold "nanoshells" can help to combat cancer. When nanoshells enter tumour cells and are exposed to radiation, they absorb the energy and warmth up sufficiently to kill cancer cells. Other elements, additionally to gold, will be utilised.

## Surgery

Nanotechnology allows for the creation of small surgical instruments and robots that may be accustomed to accomplish microsurgeries on any portion of the body. instead of causing extensive damage to the body, these instruments would be precise and exact, focusing just on the areas where surgery is required.
Surgery visualisation may be improved. Computers can operate nano-sized surgical instruments rather than a surgeon holding the device. “Nanocameras” can enable clean up visualisation of the surgery.

Reinstate vision: it's possible to form genome sequencing substantially easier. it's possible to trace and identify the biological causes of mental illnesses. Curiosity will be piqued and piqued again.
Tissue engineering: Tissue engineering makes use of nanomaterial-based scaffolds and growth agents to artificially drive cell multiplication. Advances in nanotechnology-based tissue engineering could help humans and other animals live longer lives.[7]

**Nano robotics**

Although nano-robotics has many applications in various industries, it's most useful and versatile in medical fields. Subsequent medical nanotechnology is predicted to use nanorobots implanted within patients to perform cellular-level treatment.

**Risk Factors:**

The number of studies demonstrating the various medicinal applications of nanotechnology and nano-materials has grown exponentially. Nanoparticles and nano-materials constitute a risk to human health and therefore the environment; molecular manufacturing (or advanced nanotechnology) poses a risk to society; and societal risks are all factors to contemplate. Well, like many previous disruptive innovations, "nanomedicine" exacerbate the divide between affluent and poor in its early stages? Is nano-medicine covered by a selected patent? what is going to nanomedicine concepts be worth? Can the poor have access to nano-medicine and supplementary nano-medical technology within the same way that the rich do?

For particular, the dimensions and extraordinary mobility of nano-particles concerns the committee: they're sufficiently little to penetrate cell membranes of the stomach lining, with the potential to enter the brain and other areas of the body, and even into the nucleus of cells if consumed.

Another factor is nanoparticles' solubility and persistence. What happens to insoluble nanoparticles, for example? Is there a risk that they'll collect and damage organs if they cannot be attenuated, digested, or degraded? Nano materials made of inorganic metal oxides and metals are regarded to be the foremost dangerous during this regard.[8]. Other related studie s were reviewed[9-10].

**CONCLUSION**

By improving the potency and safety of nanosystems and nanodevices, nanotechnology will help to reinforce health. Early detection, improved implants, cancer treatment, also barely invasive procedures for heart condition, diabetes, and other disorders also are expected. Nanotechnology will play an important part in tomorrow's medicine, bringing innovative potential for ultimate disease diagnosis , discernment and therapeutic treatments to enhance health and corporeal skills, and sanctioning precise and effectual therapy suited to the patient within the future years. Many current nanomedicine techniques are close enough to completion that their successful development is sort of inevitable, and their eventual incorporation into useful medical diagnostics or clinical therapies is kind of likely and will happen very soon. Nanomedicines still lack a widely accepted definition, and one may never be conceivable or practical.

The medicinal items are available a good form of types and structures, and they have been utilised to treat a good spectrum of acute and chronic disorders. Furthermore , current going research is quickly resulting in the emergence of more sophisticated nanostructured designs , which necessitates a radical understanding of the pharmacokinetic and pharmacodynamic properties of nanomedicines , which are determined by their physio - chemical qualities and chemical composition, posing regulatory challenges.

**COMPETING INTERESTS DISCLAIMER:**

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.



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