

# NANOTECHNOLOGY

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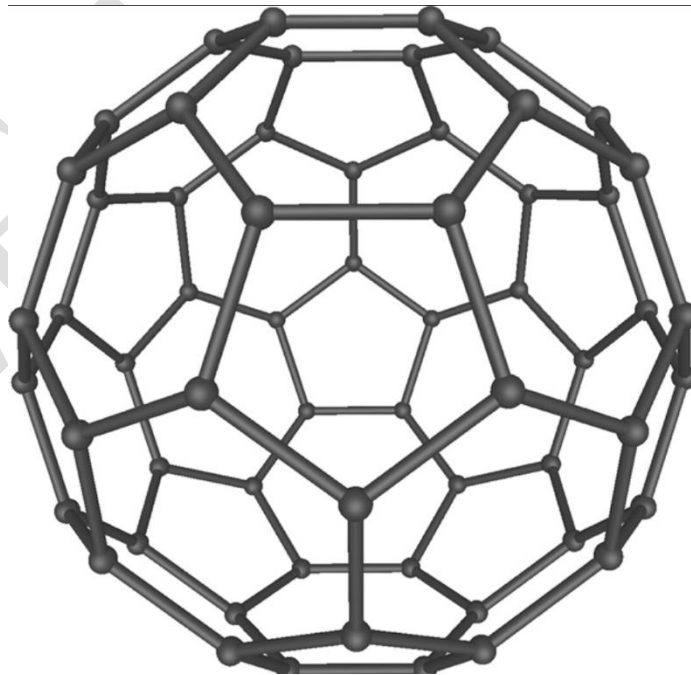
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**Abstract:** The use of nanotechnology in medicine offers some exciting possibilities. Some techniques are only imagined while others are at various stages of testing or actually being used today. Nanotechnology in medicine involves applications of nanoparticles currently under development, as well as longer range research that involves the use of manufactured Nano-robots to make repairs at the cellular level.



## 1. INTRODUCTION

Nanotechnology is being applied to or developed for application to a variety of industrial and purification processes. Purification and environmental clean-up applications include desalination of water, water filtration, waste water treatment and ground water treatment.



**FIG:- STRUCTURE OF NANO PARTICLES**

## 2. WHAT IS NANOTECHNOLOGY?

Nanotechnology is the manipulation of matter on an atomic, molecular and super molecular scale. The earliest, widespread description of nanotechnology referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology.

A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defines nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers.

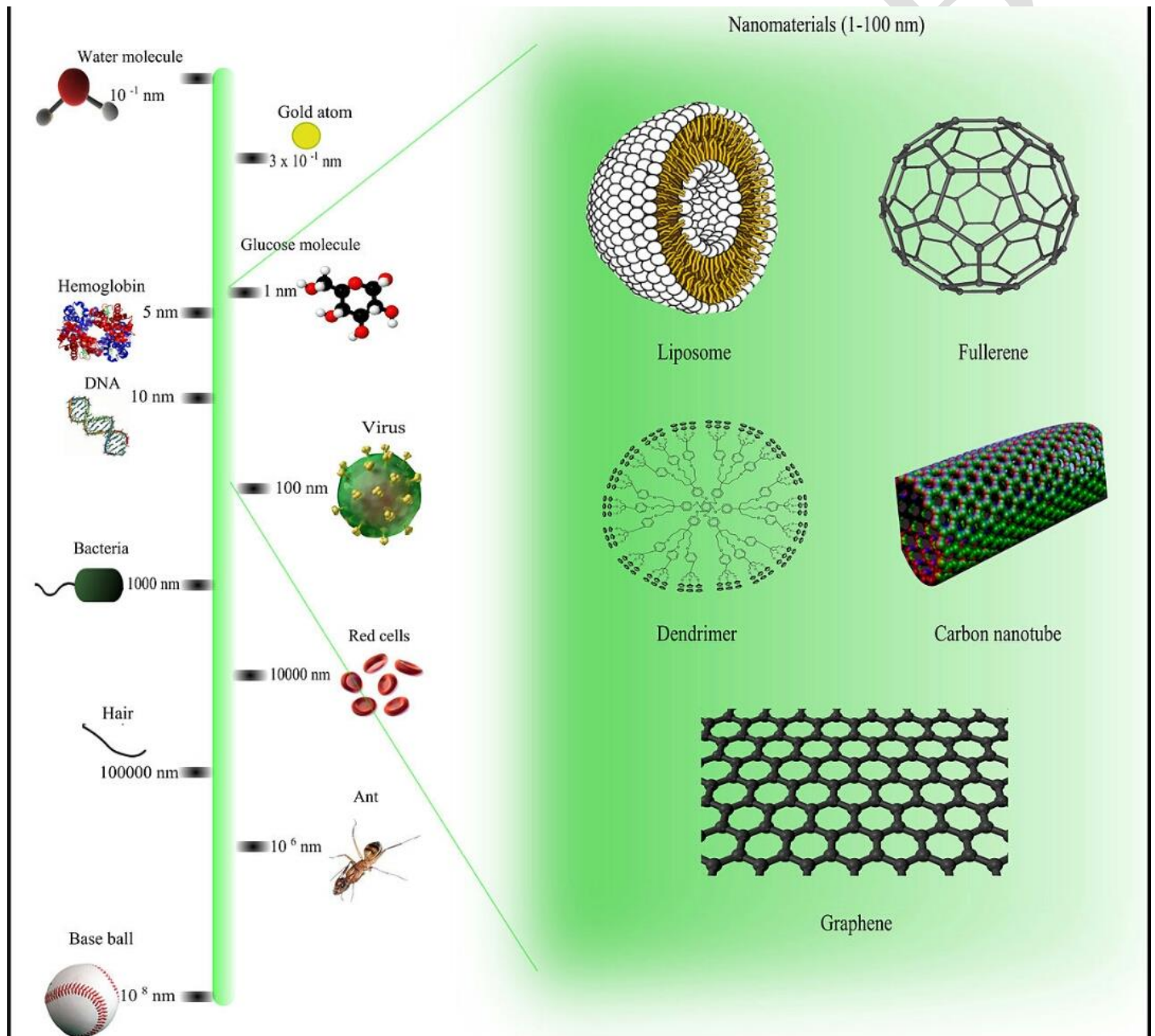


FIG:- TYPES OF NANO MATERIALS

### **3. NANOTECHNOLOGY IN MEDICINE APPLICATIONS**

#### **3.1. DRUG DELIVERY:-**

One application of nanotechnology in medicine currently being developed involves employing nanoparticles to deliver drugs, heat, light or other substances to specific types of cells (such as cancer cells). Particles are engineered so that they are attracted to diseased cells, which allows direct treatment of those cells. This technique reduces damage to healthy cells in the body and allows for earlier detection of disease.

For example, researches at North Carolina State University are developing a method to deliver cardiac stem cells to damaged heart tissue. They attach Nano vesicles that are attached to an injury to the stem cells to increase the amount of stem cells delivered to an injured tissue.

#### **3.2. DIAGNOSTIC TECHNIQUES:-**

A test for early detection of kidney damage is being developed. The method uses gold Nano rods fictionalized to attach to the type of protein generated by damaged kidneys. When protein accumulates on the Nano rods the color of the Nano rod shifts. It can also provide early detection of cancer cells in the bloodstream.

#### **3.3. ANTIBACTERIAL TREATMENTS:-**

Researchers are developing a technique to kill bacteria using gold nanoparticles and infrared light. This method may lead to improved cleaning of instruments in hospital settings.

#### **3.4. CELL REPAIR:-**

Nano robots could actually be programmed to repair specific diseased cells, functioning in a similar way to antibodies in our natural healing processes.

#### **3.5. CANCER:-**

Nanoparticles have high surface area to volume ratio. This allows for many functional groups to be attached to a nanoparticle, which can seek out and bond to certain tumor cells. Additionally, the small size of nanoparticles ( 5 to 100 nanometers), allows them to preferentially accumulate at tumor sites.

#### **3.6. BLOOD PURIFICATION:-**

The purification process is based on fictionalized iron oxide or carbon coated metal nanoparticles with ferromagnetic or super paramagnetic properties. Bonding agents such as proteins, antibodies, or synthetic ligands are covalently linked to the particle surface.

These binding agents are able to interact with target species forming an agglomerate. Applying an external magnetic field gradient allows exerting a force on the nanoparticles. Hence the particles can be separated from the bulk fluid.

The small size (<100nm) and large surface area of functionalized Nano-magnets leads to advantageous properties compared to hemoperfusion, which is a clinically used technique for the purification of blood and is based on surface adsorption.

#### 4. COMPANY DIRECTORY – NANOTECHNOLOGY IN MEDICINE

Company	Product
<b>CYTLMMUNE</b>	Gold nanoparticles for targeted delivery of drugs to tumors
<b>BLUEWILLOW</b>	Nano-emulsions for nasal delivery to fight viruses (such as the flu and colds) or through the skin to fight bacteria

#### 5. TOOLS

- The Atomic Force Microscope (AFM) and Scanning Tunneling Microscope (STM) are two early versions of scanning probes that launched nanotechnology.
- The tip of a scanning probe can also be used to manipulate nanostructures.
- Feature oriented scanning methodology may be a promising way to implement these Nano manipulations in automatic mode.
- Various techniques of nanolithography such as optical lithography, X-ray lithography, dip pen nanolithography, electron beam lithography or Nano-imprint lithography.

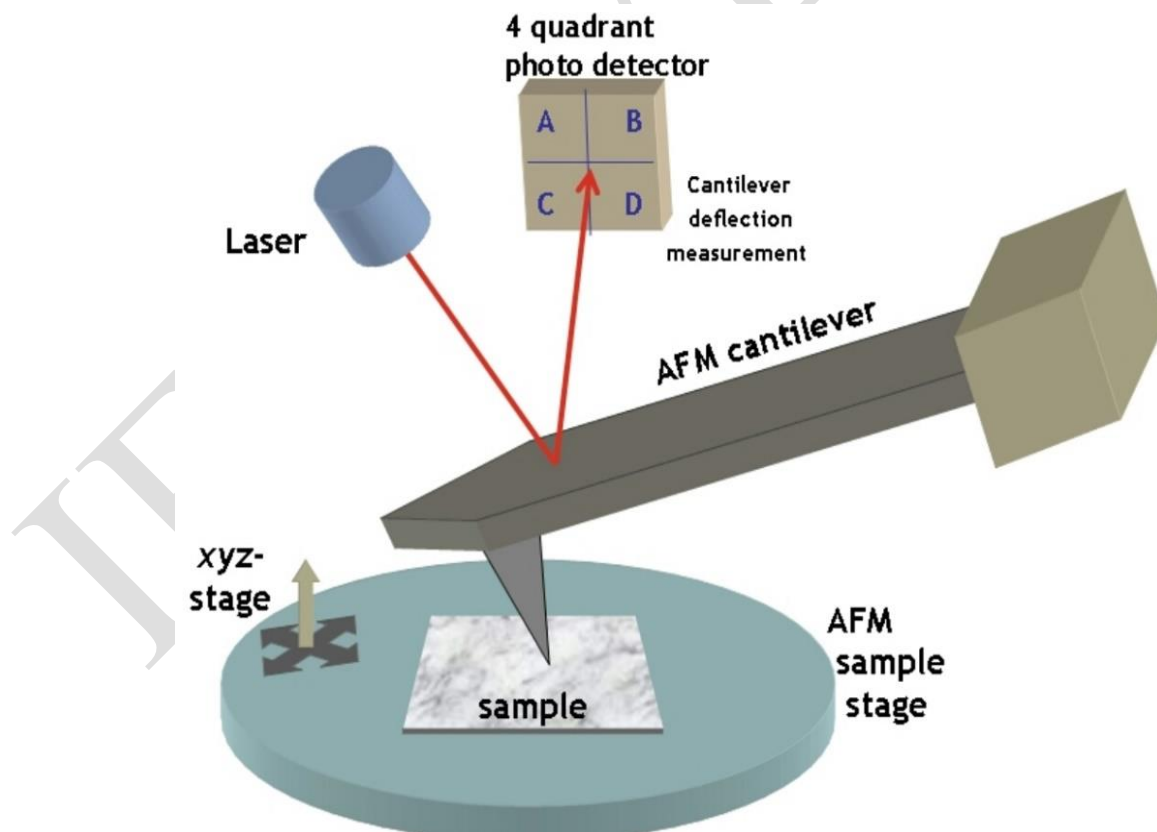


FIG:- TOOLS USED FOR NANO MATERIALS

## 6. FEATURES

### 6.1. ADVANTAGES:-

- Commercial applications have adapted gold nanoparticles as probes for the detection of targeted sequences of nucleic acids, and gold nanoparticles are also being clinically investigated as potential treatments for cancer and other diseases.
- Better imaging and diagnostic tools enabled by nanotechnology are paving the way for earlier diagnosis, more individualized treatment options, and better therapeutic success rate.
- Nanotechnology is being studied for both the diagnosis and treatment of atherosclerosis, or the build-up of plaque in arteries. In one technique, researchers created a nanoparticle that mimics the body's "good" cholesterol, known as HDL (high density lipoprotein), which helps to shrink plaque.

### 6.2. DISADVANTAGES:-

- Nanotechnology has increased the pollution, which includes water pollution, air pollution. The pollution caused by nanotechnology is known as Nano pollution.
- The potential for mass poisoning over a period of time. They may cause health problems in the consumers that use them i.e., health effects could be at large scale.
- Nanotechnology is very expensive and developing. It can cost a lot of money.

## 7. CONCLUSION

Nanotechnology has and will continue to revolutionize the world through its remarkable functions, especially in the world of medicine.

Nanotechnology is too powerful and could lead to destructive military weapons, and that research must be furthered before the naïve human race quickly rushes to use this potentially life changing new technology.