# Welcome

# Applications of Nanotechnology In Medical field

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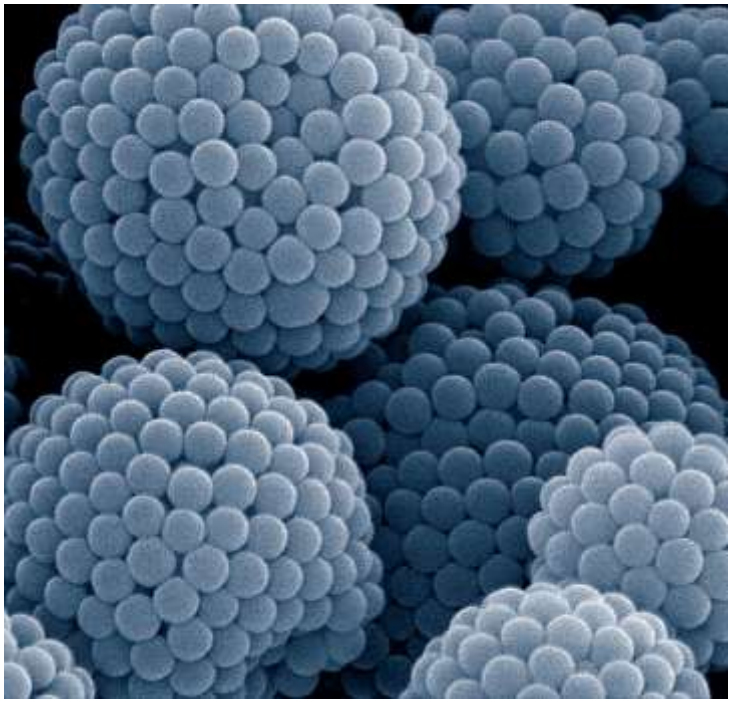
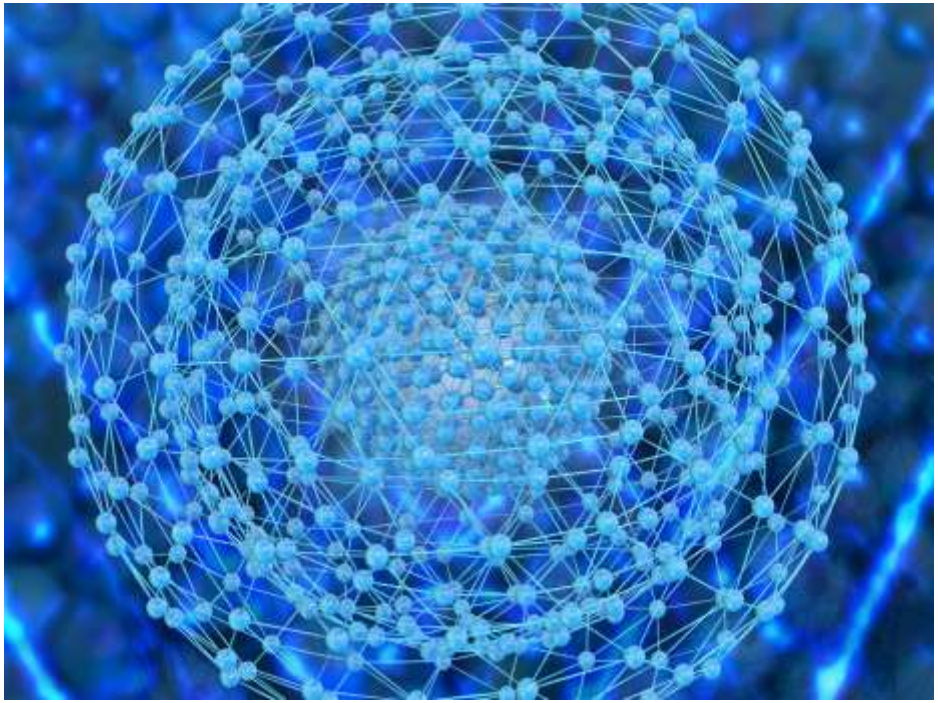
# Nanoparticles





# What are Nanoparticles?

- Particles between 1 and 100 nanometers (nm) in size with a surrounding interfacial layer are Nanoparticles
- Fine particles are sized between 100 and 2,500 nm
- Coarse particles cover a range between 2,500 and 10,000 nm

# History of Nanoparticles

- Although nanoparticles are associated with modern science, they have a long history.
- Nanoparticles were used by artisans of Rome in the fourth century in the famous Lycurgus cup made of dichroic glass
- In the ninth century in Mesopotamia for creating a glittering effect on the surface of pots.

- The **Lycurgus Cup** is a 4th-century Roman glass cage cup made of a dichoric glass, which shows a different colour depending on whether or not light is passing through it; red when lit from behind and green when lit from in front

# The father of modern nano-technology American Physicist Richard Feyman

According to the American Physicist Richard Feyman , the father of modern nanotechnology,

“There is plenty of room at the bottom"

# Bulk material Vs Nanoparticles

- A bulk material should have constant physical properties regardless of its size
- but at the nano-scale size-dependent properties are often observed.
- Nanoparticles often possess unexpected optical properties as they are small enough to confine their electrons and produce quantum effects

# Applications of Nano-technology in the field of health care

- Drug delivary
- Imaging
- Sensing
- Blood purification
- Tissue engineering
- Medical devices

# Drug delivery

- Nanotechnology has provided the possibility of delivering drugs to specific cells using nanoparticles.
- The overall drug consumption may be lowered significantly
- Targeted drug delivery is intended to reduce
- the side effects of drugs
- decrease in consumption and
- treatment expenses

# Imaging

1. Using nanoparticle contrast agents , images such as ultrasound and MRI have a favorable distribution and improved contrast.
2. In cardiovascular imaging, nanoparticles have potential to aid visualization of blood pooling, ischemia, angiogenesis, atherosclerosis, and focal areas where inflammation is present.
3. Quantum dots (nanoparticles with quantum confinement properties, such as size-tunable light emission), when used in conjunction with MRI can produce exceptional images of tumor sites.

- Cadmium selenide quantum dots  glow when exposed to UV light.
- When injected, they seep into cancer tumors. The surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal.
- These nanoparticles are much brighter than organic dyes and only need one light source for excitation.
- The use of fluorescent quantum dots could produce a higher contrast image and at a lower cost than today's organic dyes used as contrast media.
- The downside, is that quantum dots are usually made of quite toxic elements, but this concern may be addressed by use of fluorescent dopants.

# Blood purification

- Functionalized iron oxide or carbon coated metal nanoparticles with ferromagnetic or superparamagnetic properties are used for blood purification. The technology is available under the name Magnetic-activated cell sorting or Dynabeads
- Magnetic nanoparticles can be used for the removal of various noxious compounds including toxins, pathogens, and proteins from whole blood in an extracorporeal circuit similar to dialysis
- The purification with nanoparticles allows specific targeting of substances.
- Larger compounds which are commonly not dialyzable can be removed
- The application of an external magnetic field gradient exerts a force on the nanoparticles. Hence the particles can be separated from the bulk fluid, thereby cleaning it from the contaminants such as cytokines or endotoxins.

# Tissue engineering

- Nanoparticles such as graphene, carbon nanotubes, molybdenum disulfide and tungsten disulfide are being used as reinforcing agents to fabricate mechanically strong biodegradable polymeric nanocomposites for bone tissue engineering applications.
- The addition of these nanoparticles in the polymer matrix at low concentrations (~0.2 weight %) leads to significant improvements in the compressive and flexural mechanical properties of polymeric nanocomposites
- A suspension of gold-coated nanoshells activated by an infrared laser can be used to weld arteries during surgery.

# Nanomedicine

- Nanomedicine ranges from
- nanomaterials,
- biological devices
- nanoelectronic biosensors
- molecular nanotechnology such as biological machines.

# Medical devices

- Neuro-electronic interfacing is a visionary goal dealing with the construction of nanodevices that will permit computers to be joined and linked to the nervous system.
- Molecular nanotechnology, such as molecular assemblers and introduced into the body, to repair or detect damages and infections.
- Nanomedicine could give rise to life extension through the repair of many processes thought to be responsible for aging.

# Conclusion

- Nanotechnology has provided the possibility of delivering drugs to specific cells using nanoparticles
- Using nanoparticle contrast agents , images such as ultrasound and MRI have improved contrast
- Neuro-electronic interfacing is a visionary goal dealing with the construction of nanodevices
- Blood purification using nanoparticles are having better reullts than dialysis
- tissue engineering helps to reproduce or repair or reshape damaged tissue using suitable nanomaterial-based scaffolds and growth factors.
- Molecular machines which could re-order matter at a molecular or atomic scale. Nanomedicine would make use of these nanorobots, introduced into the body, to repair or detect damages and infections.

# Thank You