Nanotechnology In Medical Genetics

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Nanotechnology

- **Nanotechnology** has introduced a great scientific advancement in the field of research and technology, especially its various applications in the information technologies and medical applications.
- Nanotechnology is an important field of modern research dealing with synthesis , strategy and manipulation of particles structure ranging from approximately 1 to 100 nm in size.

A Brief History of Nanotechnology

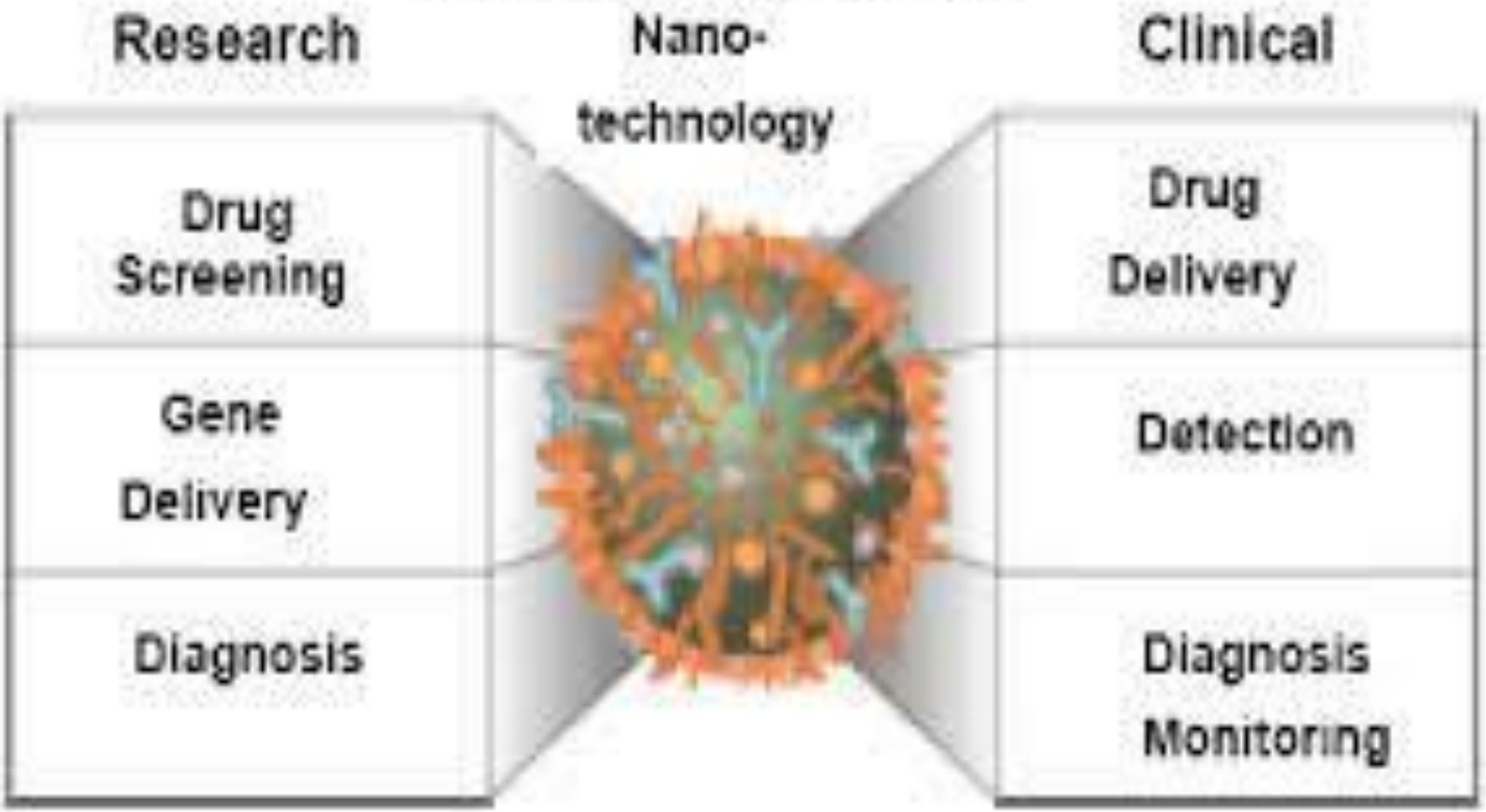
- On December **29, 1959,** physicist **Richard Feynman** gave a radical lecture at an American Physical Society meeting titled “There’s Plenty of Room at the Bottom
- **Richard** suggested that it should be possible to make machines at a nano-scale that "arrange the atoms the way we want", and do chemical synthesis by mechanical manipulation.
- This lecture was the birth of the idea and study of **nanotechnology.**

Applications Nanotechnology in Medical

- Applications of medical nanotechnology span across a variety of areas such

- **In Diagnostics of genetic diseases (abnormal conditions).**
- **In Surgery.**
- **Vaccine development.**
- **Personalization of medical treatments.**
- **Gene therapies.**

Medical Application



Diagnosis of genetic diseases

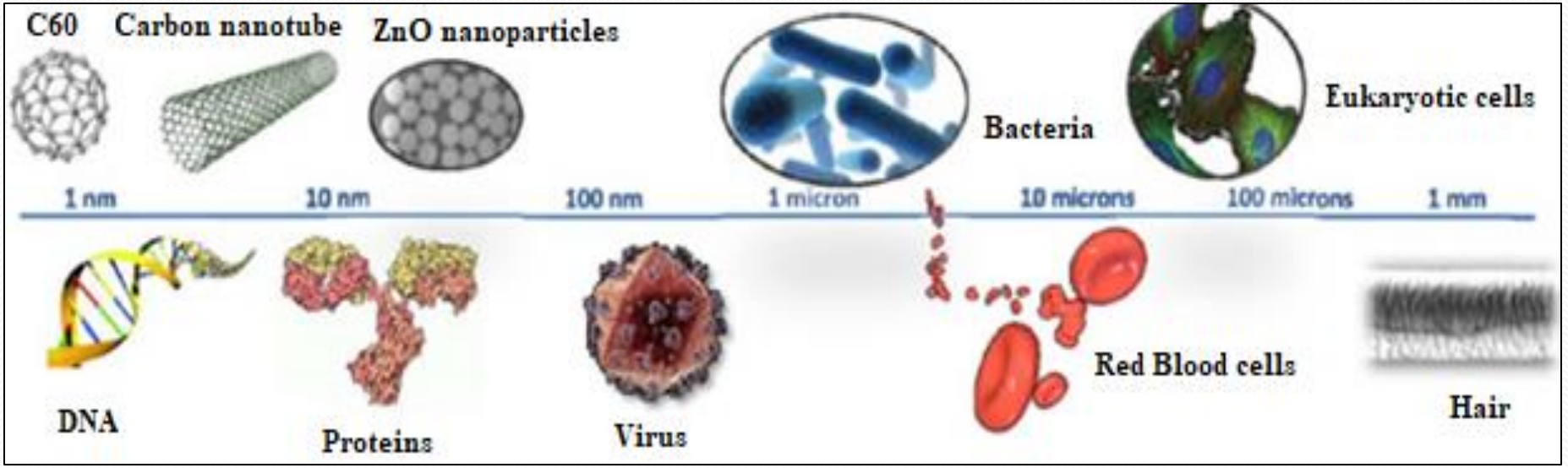
- Genetic advances make it possible to develop **early diagnostic tests, new treatments, or interventions ranging** from avoiding the disease to minimizing its severity. In particular, Nanotechnology plays **role in inherited disease diagnosis**. Disorders of this type are due to mutations in a single gene, and these mutation identification allow accurate and early diagnosis.

Gene therapies

- **Gene therapies** are an advanced way of treating genetic diseases. They consist of **introducing modified genetic material** (**Nanotechnology**) **into the patient's cells** with the aim of correcting the mutation responsible for the disease. Although **still in the experimental phase**, these therapies promise to be an effective way of treating genetic diseases in the future.

Nanoparticles

- **Nanoparticles** (NPs) are small sized particles having a size range of 1-100 nm, which play an important role in our daily lives, furthermore, it has pronounced importance in the fields of biotechnology such as food, medical and pharmaceutical industry .
- In microbiology, nano-sized antimicrobials are extremely responsive and preferred over original sized antimicrobial agents largely because of their high surface area, researchers approved that NPS have antimicrobial and anti-biofilm properties against various fungal, bacterial and other microbial species .



This figure represents the Size comparison: nanoparticles and biological systems

Genetic nanotechnology

- **nanotechnology** holds significant promise for gene manipulation, researchers are also looking at advancing nanotechnology through the use of genetic materials.
- **DNA nanotechnology** is a branch of nanotechnology concerned with the **design, study and application** of synthetic structures based on DNA.
- **DNA nanotechnology** takes advantage of the physical and chemical properties of DNA rather than the genetic information it carries.

Example for application of nanotechnology in medical genetics

- **Nanomedicine defined as the application of nanotechnology in the medical field and has the potential to significantly change the course of diagnostics and treatment of life-threatening diseases that including to cure diseases and repair damaged tissues such as bone, muscle, and nerve.**
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- Currently, nanotechnology is playing an increasingly important role in antiviral therapy for coronaviruses.
- Nanomaterials have been developed specifically to improve the delivery of bio therapeutics across physiological barriers.
- A broad range of potential Nano devices, such as Nano sensors, Nano-based vaccines, and smart nanomedicines, offers great hope for combating current and future mutated versions of coronaviruses.

Example of Nanoparticles

- Specific properties and characteristics of zinc oxide (ZnO) nanoparticles, such as their inherent toxicity against cancerous cells.
- In vitro studies have shown that ZnO nanoparticles can be highly toxic to cancer cells or bacteria. Therefore, not only have ZnO nanomaterials been investigated as drug/gene delivery vehicles, they have also been studied for cancer therapy.

- The synergistic cytotoxic effect of the ZnO nanoparticles which can cause DNA damage and induce apoptosis in cells against cancer cells and the presence of ZnO nanoparticles lead to enhance cellular uptake of DNA and inhibit proliferation of the cancer cell.


Thank
you