

Fundamental Concepts of Nanotechnology in Molecular Scale

Ankhita Chobe*

Professor of Pharmacy, Government College of Pharmacy (GCP), Bangalore

Editorial

Nanotechnology, also shortened to nanotech, is that the use of matter on an atomic, molecular, and supra molecular scale for industrial purposes. The earliest, widespread description of nanotechnology mentioned the actual technological goal of precisely manipulating atoms and molecules for fabrication of macro scale products, also now mentioned as molecular nanotechnology. A more generalized description of nanotechnology was subsequently established by the National Nanotechnology Initiative, which defined nanotechnology because the manipulation of matter with a minimum of one dimension sized from 1 to 100 nanometres. This definition reflects the very fact that quantum mechanical effects are important at this quantum-scale, then the definition shifted from a specific technological goal to a search category inclusive of all kinds of research and technologies that affect the special properties of matter which occur below the given size threshold. It's therefore common to ascertain the plural "nanotechnologies" also as "Nano scale technologies" to ask the broad range of research and applications whose common trait is size.

Nanotechnology as defined by size is of course broad, including fields of science as diverse as surface science, chemistry, biology, semiconductor physics, energy storage, engineering, micro fabrication and molecular engineering. The associated research and applications are equally diverse, starting from extensions of conventional device physics to completely new approaches based upon molecular self-assembly from developing new materials with dimensions on the Nano scale to direct control of matter on the atomic scale.

Scientists currently debate the longer term implications of nanotechnology. Nanotechnology could also be ready to create many new materials and devices with a huge range of applications, like in Nano medicine, Nano electronics, biomaterials energy production, and consumer products. On the opposite hand, nanotechnology raises many of an equivalent issue as any new technology, including concerns about the toxicity and environmental impact of nanomaterials and their potential effects on global economics, also as speculation about various doomsday scenarios. These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

Fundamental Concepts

Nanotechnology is that the engineering of functional systems at the molecular scale. This covers both current work and ideas that are more advanced. In its original sense, nanotechnology refers to the projected ability to construct items from rock bottom up, using techniques and tools being developed today to form complete, high performance products.

One nanometre (nm) is one billionth, or 10^{-9} , of a meter. By comparison, typical carbon-carbon bond lengths, or the spacing between these atoms during a molecule, are within the range 0.12–0.15 nm, and a DNA double-helix features a diameter around 2 nm. On the opposite hand, the littlest cellular life-forms, the bacteria of the genus *Mycoplasma*, are around 200 nm long. By convention, nanotechnology is taken because the scale range 1 to 100 nm following the definition employed by the National Nanotechnology Initiative within the US. The lower limit is about by the dimensions of atoms (hydrogen has the littlest atoms, which are approximately $1/4$ of an nm kinetic diameter) since nanotechnology must build its devices from atoms and molecules. The upper limit is more or less arbitrary but is round the size below which phenomena not observed in larger structures start to become apparent and may be made use of within the Nano device. These new phenomena make nanotechnology distinct from devices which are merely miniaturised versions of the same macroscopic device; such devices are on a bigger scale and are available under the outline of micro technology.

To put that scale in another context, the comparative size of a nanometre to a meter is that the same as that of a marble to the dimensions of the world or differently of putting it: a nanometre is that the amount a mean man's beard grows within the time it takes him to boost the razor to his face. Two main approaches are utilized in nanotechnology. Within the "bottom-up" approach, materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition within the "top-down" approach. Nano-objects are constructed from larger entities without atomic-level control

Areas of physics like Nano electronics, Nano mechanics, Nano photonics and Nano Ionics have evolved during the previous couple of decades to supply a basic scientific foundation of Nanotechnology.

*Address for Correspondence: Ankhita Chobe, Professor of Pharmacy, Government College of Pharmacy (GCP), Bangalore, Tel: 912222782730; E-mail: ankhitchobe@gmail.com

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