

Nanotechnology: A branch of technology dealing with the manufacture of objects with dimensions between approximately 1 and 100 nanometers, and the manipulation of individual molecules and atoms.

The term “**Nano**” comes from the Greek word “Nanos” meaning dwarf and denotes a measurement on the scale of one-billionth (10^9) of a meter in size.

How it started

The ideas and concepts behind nanoscience and nanotechnology started with a talk entitled “**There’s Plenty of Room at the Bottom**” by physicist **Richard Feynman** at an American Physical Society meeting at the California Institute of Technology on December 29, 1959, long before the term nanotechnology was used. In his talk, Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. Over a decade later, in his explorations of ultra-precision machining, Professor **Norio Taniguchi** coined the term nanotechnology. It wasn't until 1981, with the development of the scanning tunneling microscope that could "see" individual atoms that modern nanotechnology began.

What Can Nanotechnology Do?

Nanotechnology is hailed as having the potential to increase the efficiency of:

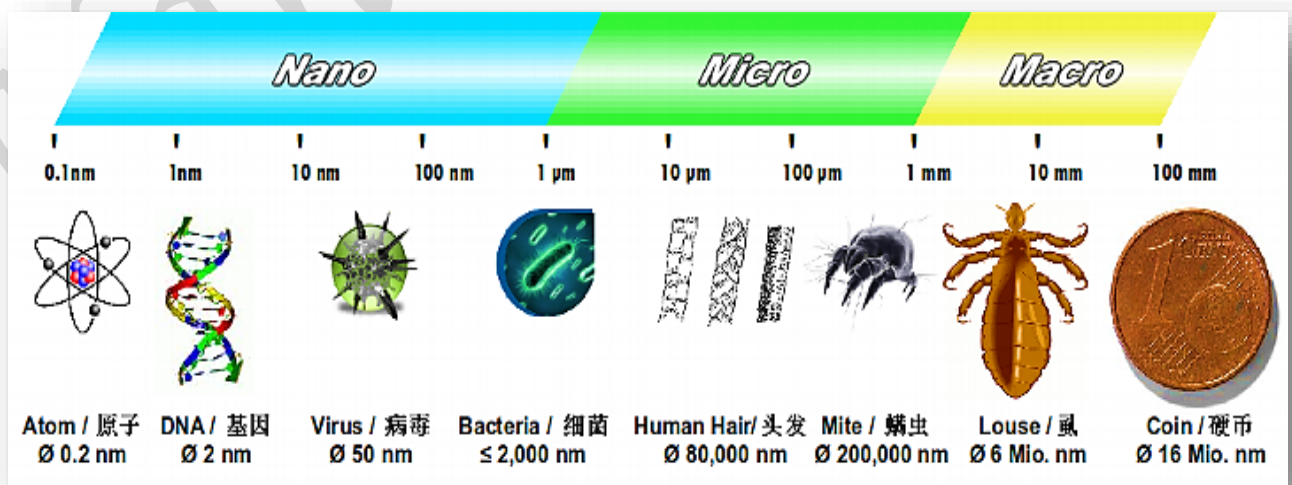
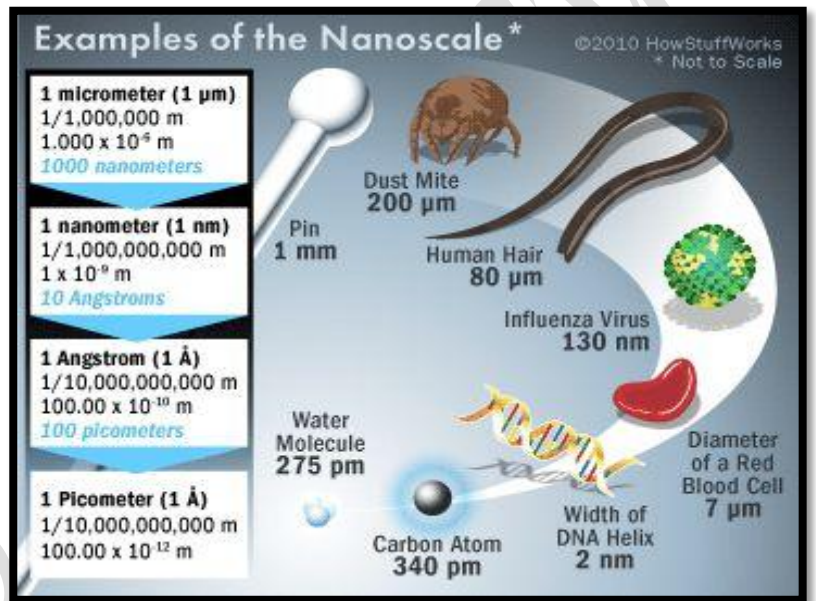
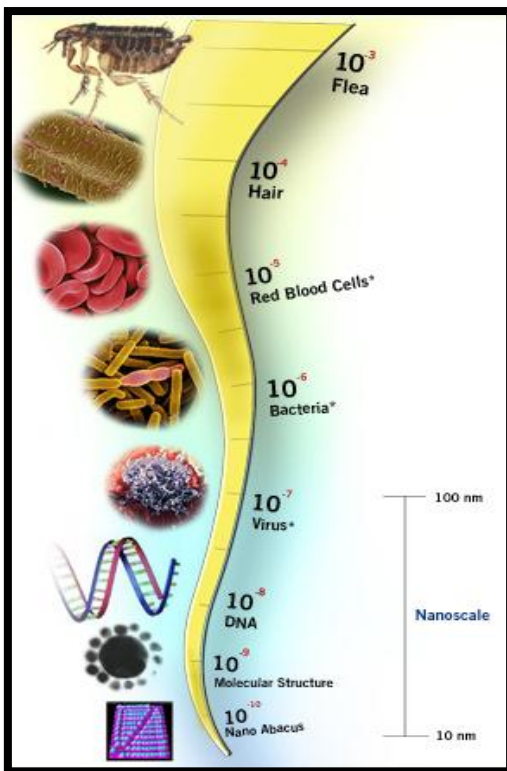
- **Energy consumption**
- **Clean the environment**
- **Solve major health problems.**

It is said to be able to massively increase manufacturing production at significantly reduced costs. Products of nanotechnology will be **smaller, cheaper, lighter** yet more functional and require **less energy** and **fewer raw materials** to manufacture, claim nanotech advocates.

Terms in Nanotechnology

1- Nanoscience: is the study of structures and materials on the scale of nanometers. To give you an idea of how long a nanometer is, this printed page is about 75,000 nanometers thick. When structures are made small enough—in the nanometer size range—they can take on interesting and useful properties.

2- Nanoscale: having one or more dimensions of the order of 100 nm or less.



- 3- Nano-biotechnology:** is an emerging field of nanotechnology with biochemical and biological applications or activities. It integrates biotechnology on the nanoscale. In order to engineer new devices (biosensors), existing elements of nature has been studied in nanobiotechnology. Nanobiotechnology refers to goals of biotechnology with the use of nanotechnology.
- 4- Bio-nanotechnology:** usually refers to intersect between biotechnology and nanotechnology. It often includes the use of biomolecules (any organic molecule produced by a living organism such as plant, bacteria, virus, fungi... etc) as a motivation for Nano-technological devices. In the other word it means synthesis of nanomaterial by living organism or biology system.
- 5- Nano-composite:** Nano-composites are composites with nanoparticles (its size in nanoscale) mixed into a matrix. The matrix must consist of a different type of material than the particulates. Common Nano-composites consist of a polymer matrix with ceramic nanoparticles. The particulates added have a higher modulus than the matrix material. These particles cause an increase in strength of the overall composite. It means Nano-composites is composite in which at least one of the phases has at least one dimension on the nanoscale.
- 6- Nanomaterial:** material with one or more external dimensions, or an internal structure, which could exhibit novel characteristics compared to the same material without nanoscale features. Nanomaterials fabrication methods can be classified according to whether their assembly followed either:
 - **Bottom-up approach:** where smaller components of atomic or molecular dimensions self-assemble together, according to a natural physical principle or an externally applied driving force, to give rise to larger and more organized systems.
 - **Top-down approach:** a process that starts from a large piece and subsequently uses finer and finer tools for creating correspondingly smaller structures.
- 7- Nanoparticle:** particle with two or more dimensions at the nanoscale. New research defined it as a particle with all three external dimensions in the nanoscale.
- 8- Nanostructured:** having a structure at the nanoscale.
- 9- Nanofibre:** Nano-object with two similar external dimensions in the nanoscale and the third dimension significantly larger. A nanofibre can be flexible or rigid. The two

similar external dimensions are considered to differ in size by less than three times and the significantly larger external dimension is considered to differ from the other two by more than three times. The largest external dimension is not necessarily in the nanoscale.

10- Nano-object: Material with one, two or three external dimensions in the nanoscale.

11- Nanoplate: Nano-object with one external dimension in the nanoscale and the two other external dimensions significantly larger. The smallest external dimension is the thickness of the nanoplate. The two significantly larger dimensions are considered to differ from the nanoscale dimension by more than three times. The larger external dimensions are not necessarily in the nanoscale.

Nanotechnology