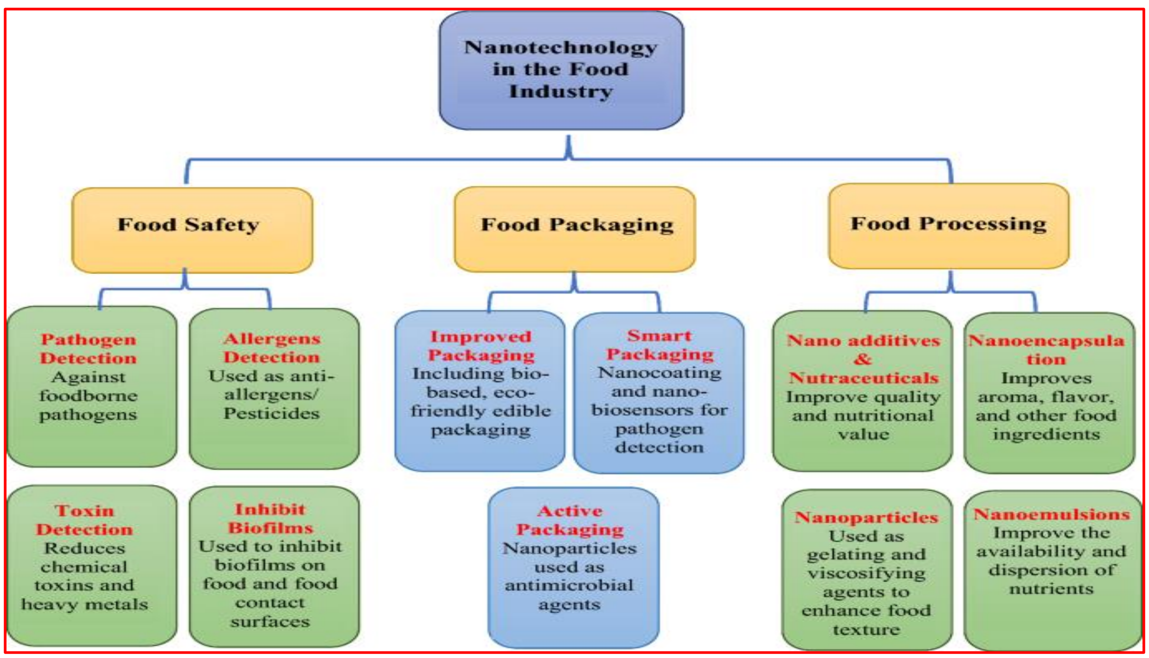
Application of Nanobiotechnology

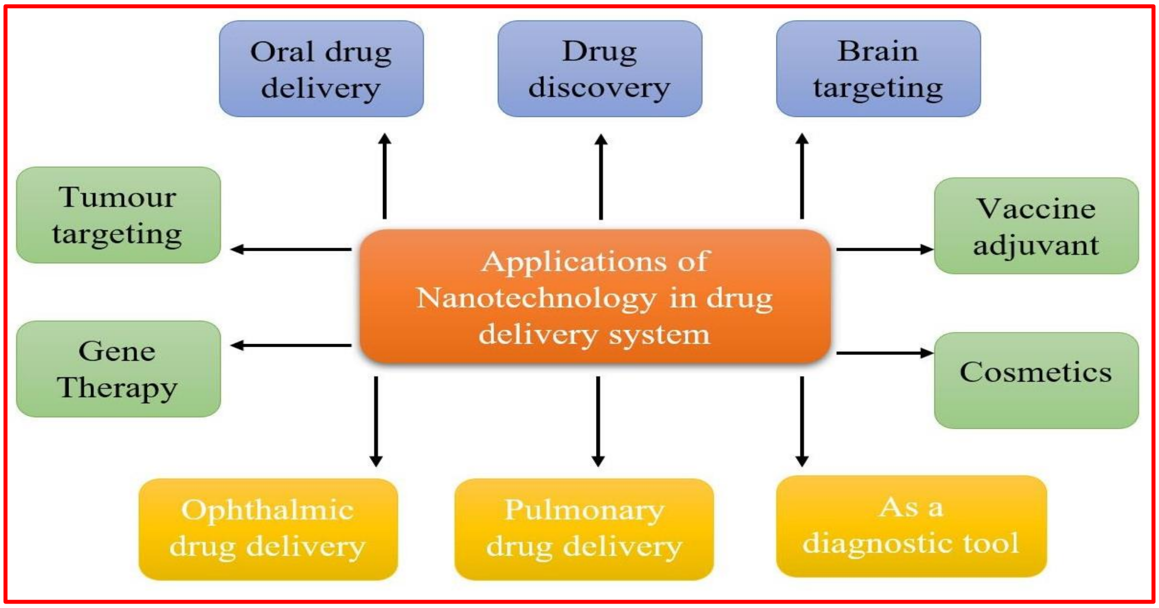
Food industry

Application of Nanobiotechnology food industry include: encapsulation and delivery of substances in targeted sites, increasing the flavor, introducing antibacterial nanoparticles into food, enhancement of shelf life, sensing contamination, improved food storage, tracking, tracing and brand protection. Nano food processing and products can change the color, flavor, or sensory characteristics; they also change the nutritional functionality, removes chemicals or pathogens from food. Nano food packaging materials may extend food life due to high barrier packaging, improve food safety, alert consumers that food is contaminated or spoiled, repair tears in packaging, and even release preservatives to extend the life of the food in the package.



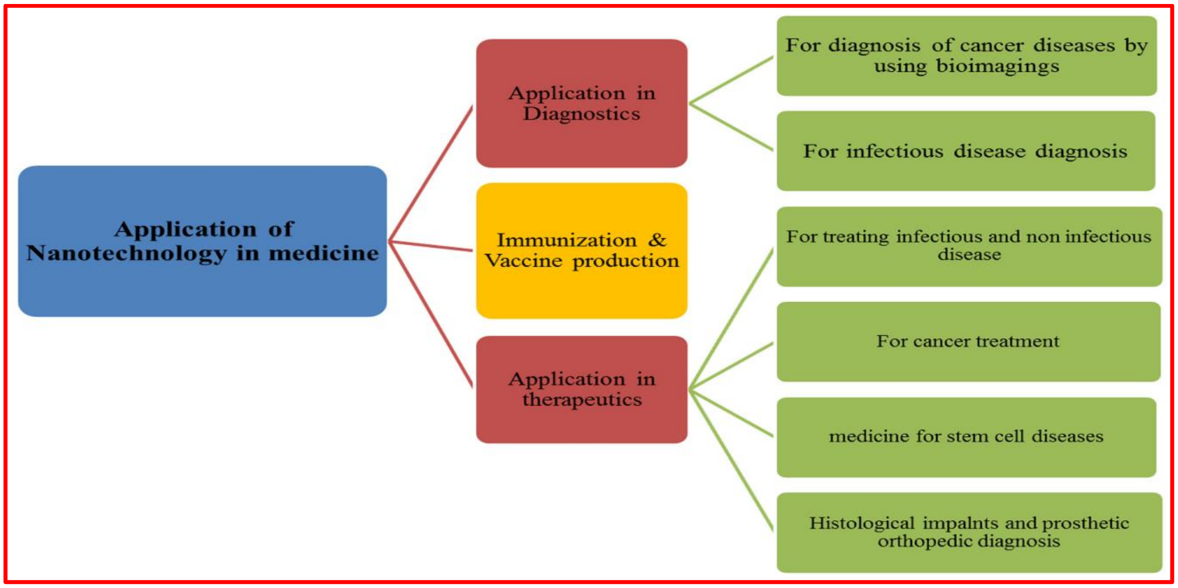
Pharmaceuticals

Nanotechnology is also being developed for use in the pharmaceutical industry to enhance pharmacokinetics, biopharmaceutical properties of drugs, and drug delivery. Nanomaterials can alter properties of the drug or other components of a drug formulation, and overcome difficulties in absorption of the drug or how it functions in the body.



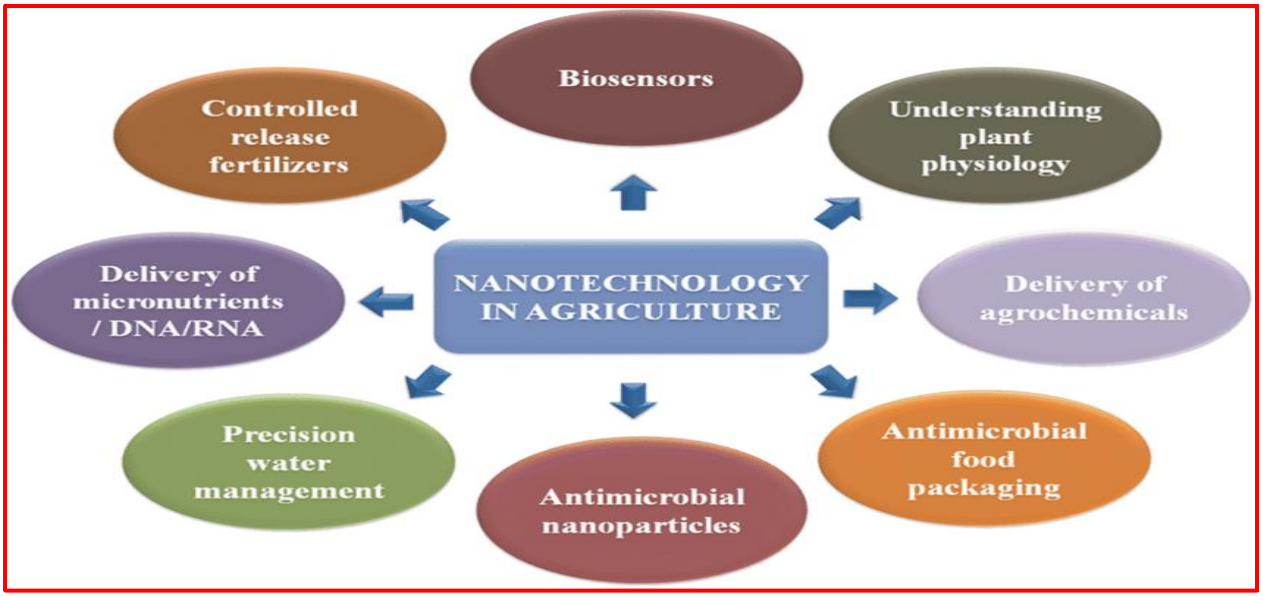
Medicine

Nanotechnology has applications in clinical medicine and diagnostics. As an example, nanotechnology-based diagnostic devices can be used to accurately test blood for disease markers. Nanorobotics is a developing field wherein machines are engineered from nanoscale components. In the field of nanomedicine, nanorobots have been used to carry out some interesting operations. Harvard and MIT scientists attached RNA strands to nanoparticles loaded with a chemotherapy drug, creating a nanomachine that could target and kill cancer cells. In another example, nanorobots were used to work with white blood cells to repair tissue.



Agriculture

Nanotechnology is being developed in agriculture to overcome the limitations of conventional farming. For example, nanotechnologies have the potential to increase the use of soil nutrients by plants. Nanofabricated materials containing plant nutrients in aqueous suspension and hydrogels are being studied for use in growing crops. Zero-valent iron nanoparticles or nanoparticles from iron rust could be used to remediate soils contaminated with pesticides, heavy metals, and radionuclides. Nanotechnology is also being used for genetic modification of plants through delivery of genes and drug molecules at the cellular level.



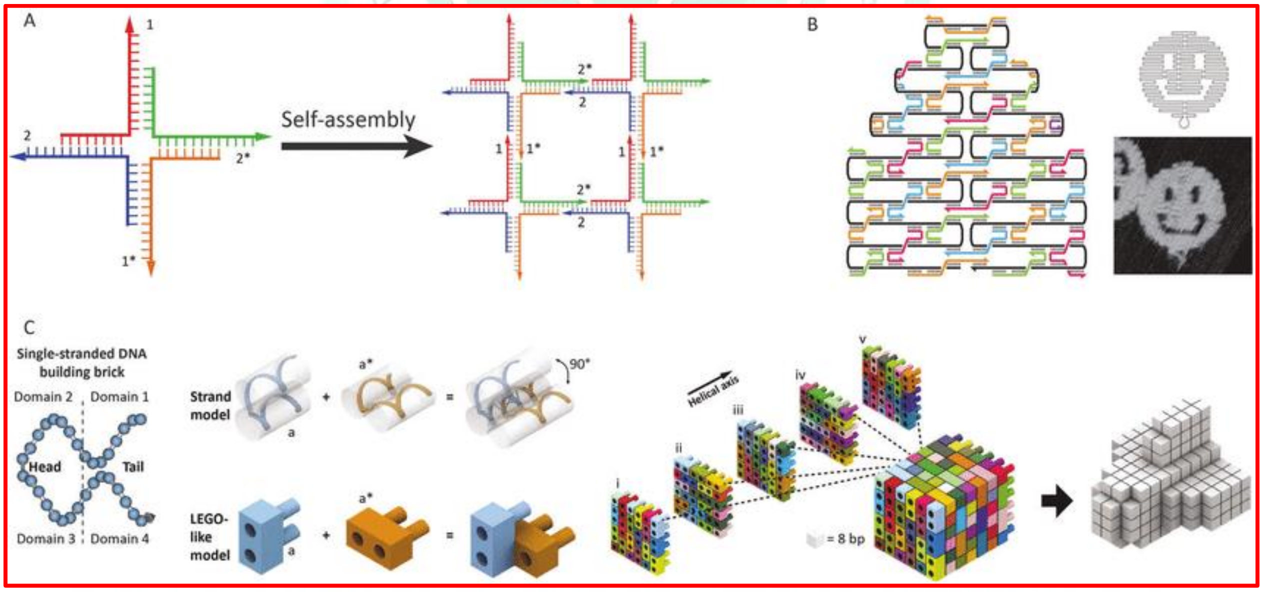
DNA Nanotechnology

DNA stands for deoxyribonucleic acid. DNA is present inside the cells of every living thing. It contains the chemical instructions and genetic information to help organisms develop and function DNA is only two nanometers across, but if you could unravel all the strands from just one cell and line them up end to end, you'd have a thread two meters long Most of our DNA—99.5%—is the same as every other person's, but a small amount is unique. Only identical twins have exactly the same DNA as another person The human genome (all of our genetic material) is contained in 46 long, thin "threads" called chromosomes. Each person inherits 23 chromosomes from each of our parents, for a total of 46 chromosomes Human DNA is made of two long strands that are twisted together, in a structure called a double helix. It looks like a long, spiral ladder DNA nanotechnology uses DNA and other nucleic acids as structural materials, taking advantage of their ability to self-assemble in order to create new nanoscale structures. Applications of DNA nanotechnology include DNA computing, where DNA arrays perform computation as they assemble, and nanoarchitecture, where DNA is used as a template to assemble other molecules.

DNA nanotechnology is sometimes divided into two overlapping subfields: structural DNA nanotechnology and dynamic DNA nanotechnology.

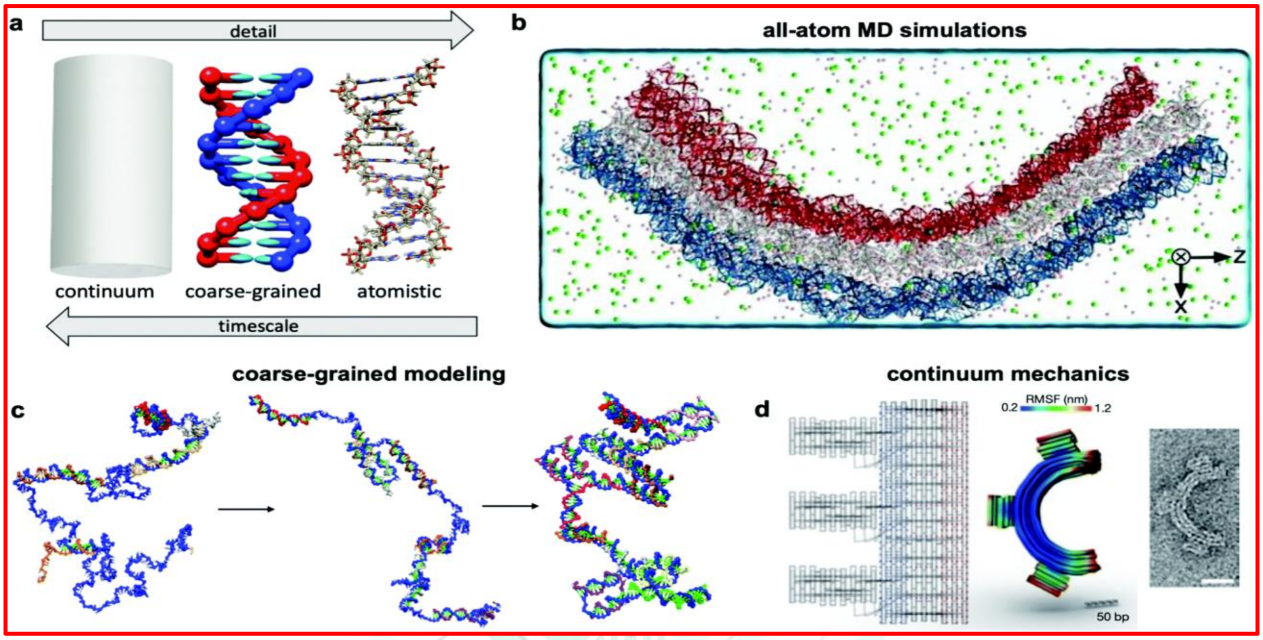
Structural DNA nanotechnology

Structural DNA nanotechnology, sometimes abbreviated as SDN, focuses on synthesizing and characterizing nucleic acid complexes and materials where the assembly has a static, equilibrium endpoint. The nucleic acid double helix has a robust, defined three- dimensional geometry that makes it possible to predict and design the structures of more complicated nucleic acid complexes. Many such structures have been created, including two- and three-dimensional structures, and periodic, aperiodic, and discrete structures.



Dynamic DNA nanotechnology

Dynamic DNA nanotechnology focuses on forming nucleic acid systems with designed dynamic functionalities related to their overall structures, such as computation and mechanical motion. There is some overlap between structural and dynamic DNA nanotechnology, as structures can be formed through annealing and then reconfigured dynamically, or can be made to form dynamically in the first place. Nanotechnology is often defined as the study of materials and devices with features on a scale below 100 nanometers .



DNA nanotechnology, specifically, is an example of bottom-up molecular self-assembly, in which molecular components spontaneously organize into stable structures; the particular form of these structures is induced by the physical and chemical properties of the components selected by the designers.

In DNA nanotechnology, the component materials are strands of nucleic acids such as DNA; these strands are often synthetic and are almost always used outside the context of a living cell.

The DNA is well-suited to nanoscale construction because (the binding between two nucleic acid strands depend on simple base pairing rules which are well understood, and form the specific nanoscale structure of the nucleic acid double helix). These qualities make the assembly of nucleic acid structures easy to control through nucleic acid design. This property is absent in other materials used in nanotechnology, including proteins, for which protein design is very difficult, and nanoparticles, which lack the capability for specific assembly on their own.