

Editorial

NANO IS TOO BIG: WILL IT FULFIL THE PROMISE??

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Influence of nanotechnology is ever increasing and affecting almost every walk of human life. Nanotechnology has proven to be very useful in the fields of medicine and a new area is being developed as Nano medicine. Nanotechnology is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, and among many others. It has significant applications in electronics industry with reducing the sizes of the electronic gadgets; the best example is the smart phones and the new Nano televisions. Other areas which are influenced significantly area include but not restricted to food, fuel cells, solar cells, batteries, space research, fuels, batter air quality, better water quality, improved delivery of fertilizers, and insecticides, chemical sensors, sporting goods and fabric besides many others where Nano is bring miraculous changes in the product development and applications.

The global nanotechnology market is poised to exceed US \$ 125 Billion by 2024. Some of the growing areas include (Source:<https://www.prnewswire.com/news-releases/global-nanotechnology-market-2018-2024-market-is-expected-to-exceed-us-125-billion-300641054.html>):

- The top three applications of nanotechnology are electronics, energy and biomedical. Together, they account for over 70% share of the global nanotechnology market.
- The largest application for nanotechnology is electronics.
- The energy application captured second highest share of the nanotechnology market, being followed by biomedical application.

- The cosmetic industry is one of the most enthusiastic early adopters of nanotechnology.
- The global defense application market for nanotechnologies was valued at nearly US\$ 3 Billion in 2017.
- Automotive application captured nearly 5% share of the global nanotechnology market.

In true sense Nano is too big. However, with the recent advances in material sciences and analytical equipment's, the scientists are looking at materials at Pico level, Pico meter, Pico gram. If these methods grow as fast as their previous generation equipment's, then truly **Nano will be too big** as the scientist will be looking at the Pico level materials and we will see another revolution in the material sciences which will be at Pico level. So in future it appears that **Nano will be too big** as we all will be working on Pico level materials.

But the question we need to ask is whether the Nano will fulfill all the expectations it has created in the last two decades especially in the field of health care? Nanotechnology is already expanding the medical technologies, diagnosis, and therapies currently available to clinicians. Nanomedicine, the application of nanotechnology in medicine, draws on the natural scale of biological phenomena to produce precise solutions. Nanomedicine has applications in disease prevention, diagnosis, and treatment. Some of the major advances in this area are enumerated below but it does not cover all the applications (Source: <https://www.nano.gov/you/nanotechnology-benefits>):

- Commercial gold nanoparticles as probes in the detection of targeted sequences of nucleic acid, in the treatment of cancer and other diseases.
- Nanotechnology based better imaging and diagnostic tools for better therapeutic success.
- Solid-state nano pore materials for the development of novel gene sequencing technologies that enable single-molecule detection at low cost and high speed with minimal sample preparation and instrumentation.
- Anti-cancer drug targeting using nanoparticles to deliver medication directly to cancer cells and minimize the risk of damage to healthy

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tissue. This has the potential to change the way doctors treat cancer and dramatically reduce the toxic effects of chemotherapy.

- Nanotechnology based regenerative medicines for bone and tissue engineering.
- Graphene nanoribbons to help repair spinal cord injuries. The preliminary research shows that neurons grow well on the conductive graphene surface.
- Nanotechnology based vaccine delivery without the use of needles. Researchers also are working to create a universal vaccine scaffold for the annual flu vaccine that would cover more strains and require fewer resources to develop each year.

While advances in Nano medicine are allowing tailored drugs delivery, other developments are generating health and environmental concerns. With more than 5000 patents being issued there is a concern about the safety and challenges posed by the Nano particles to human body due to its small size. Regulators (US-FDA), health scientists, physicians, environmentalists have been increasingly concerned about the exposure and their side effects. Understanding the pharmacokinetics and pharmacodynamics of Nano particles in human body is challenging and that is affecting the utilization of this technology for disease treatment. In spite of the challenges there more than 350 clinical trials, majority of which are for the treatment of various types of cancer, are undergoing and some of those are showing significant promise for the cancer treatment and prolonging the life span of the cancer patients. It appears that **Nano is truly too big**, but then it will take some time and efforts to prove its efficacy in health care delivery and the preliminary results are definitely showing significant positive results.

Let us wait and watch to see in case of Nano how big is too big AS = the absorbance in the presence of the sample`s extracts and standards