

## The Nanotechnology Boom in Health

2021-05-05

The field of nanotechnology began in the early 90's with the discovery that something different happens when materials are manufactured at scales much less than a micrometer. The properties of most materials undergo a transformation below around 100-200 nm (a micrometer is 1000 nm). Some materials become conducting, some become as strong as steel, or wear resistant, or radiation absorbers, develop catalytic properties, and so on.

For the purpose of this article the most interesting finding is that materials at the nanoscale become highly biologically active, can target individual cells and even sub-cellular defects, can penetrate to areas of the body not previously considered possible, synergize with the immune system favorably, can easily penetrate the skin, improve the action of medicines and vaccines, etc. From the point of view of healthcare this is an astonishing list of capabilities that can be favorably exploited to provide a means to treat diseases in ways that could not have been dreamt of before 2000.

There are over 400 major nanotech companies worldwide, of which half are nanomedicine related. The combined turnover of these companies are an impressive 100 billion dollars. [India](#) is also waking up to the potential of nanotechnology in healthcare. The global demand for nanotech professionals is 20 lakhs with 5 lakhs expected to be met by [India](#). There are about 30-40 mature nanotech companies in [India](#), also with half of them in some way related to healthcare.

This is the new frontier, the frontier for the young and the ambitious looking for technology/engineering/medicine interdisciplinary career bursting with opportunities for entrepreneurship, science, education and research. The number of nanotech startups has increased to about 60 in [India](#) alone, and is growing fast.

So, what are the possibilities? The very small scale of nano suggests immediately the notion of precision, and nanomedicines are also called precision medicines. They can target specific

cells, or specific genetic loci and can be delivered with the minimum of off-target effects thereby greatly reducing side effects. Cancer is an excellent example of a serious disease that causes much suffering because chemo drugs kill healthy cells. If the drugs can be targeted efficiently to the cancer cells, then toxicity can be drastically reduced.

Another example is that because of the very small size of the nanomedicines they can be specially designed to penetrate into the brain allowing the possibility of treating brain disorders with precision, such as, Alzheimer's, multiple sclerosis, Parkinson's and even epilepsies. Targeted genetic repair has exploded into the field of healthcare with the advent of CRISPR-CAS9, a technology that received the Nobel Prize, which can selectively search and repair genetic defects in cells. Nanotechnology provides new opportunities to perform CRISPR-CAS9 with considerably more efficiency and precision.

Another rapidly growing area in Nanotechnology in healthcare is the development of newer and more sophisticated implants. Tissues and organs are continuously repaired by the body, but when the body fails to perform this task well, external support is required. For example, new bone formation is dramatically enhanced by nanotech-based implants which have tremendous value in orthopedics and dental fields of application. Other implants are heart valves, liver, vasculature and so on. The holy grail is the build a complete organ using nanomaterials because the fine scale of nano will ultimately allow for engineering at such a precision cellular level. Bionic eyes are under consideration using advanced nanomaterials that can help the blind.

A third area includes medical imaging with newer and more advanced contrast agents hitting the market for improving the accuracy of medical diagnostics. Medical product containing nanotech microdevices are also expanding rapidly.

While it is true that we still have a long way to go to fully realize this technology in healthcare, the point is that the potential is huge and the only thing that is required is sufficient investment and an indomitable human spirit for creativity and innovation.

Read the [original article](#) on Deepika.