

# Nanobots: The Brand-New Development in Nanomedicine Opens New Opportunities in Treating Chronic Diseases

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## Introduction

The emerging technology of nanobots offers better chances of fighting chronic diseases including cancer. Moreover, further developments in nanomedicine market can create opportunities such as the development of artificial antibodies and artificial RBCs and WBCs.

Nanomedicine is a domain of medicine that utilizes the knowledge of nanotechnology to prevent and treat severe diseases such as cancer and heart diseases. The recent advancements in nanotechnology have enabled doctors to use nanoscale materials, including biocompatible nanoparticles and nanobots to sense the actuation purposes in a living organism. In addition, researchers now use nanomedicines to boost immunotherapy. In recent years, the nanomedicine has shown ample of innovations, which has boosted the nanomedicine market. According to Allied Market Research, the nanomedicine market was valued at \$111.91 billion in 2016, and is expected to reach \$261.06 billion by the end of 2023, registering a CAGR of 12.6% in the period of 2017–2023.

## Treatment of Cancer using Nanomedicines with the Help of Quantum Dots

From improving the quality of solar panels to treating cancer, quantum dots are widely used in various sectors. However, creating quantum dots is an extremely expensive process which generates a huge amount of waste. However, recently scientists developed a low-cost method to synthesize quantum dots using some chemicals and green leaf extracts. A team of scientists at Wales' Swansea University developed an economical and environment-friendly way to produce quantum dots from *Camellia sinensis* leaf extract. This innovative method makes the procedure economical and the byproducts are non-toxic to the environment. The research proved that the quantum dots created with tea leaves can penetrate the skin and reduce the growth of the cancer cell by about 80 percent. However, this study does not provide the ultimate cure for cancer. However, the major issues with the production of quantum dots such as high cost and toxic byproducts are solved. In addition, in-depth research can present new possibilities in treating different diseases and developing the more advanced technology. On the other hand, scientists created fucoidan-based magnetic nanomedicines that can offer effective treatment for cancer.

## Fusing Nanoparticle-Based Immunotherapy and Nanomedicines and Emergence of Nanobots

Taiwan's National Chiao Tung University (NCTU) and the China Medical University have successfully developed an innovative way to cure cancer by combining nanomedicines with immunotherapy. The research, titled, "Combination of fucoidan-based magnetic nanoparticles and immunomodulators enhances tumor-localized immunotherapy" is published in the renowned journal Nature Nanotechnology. This study is believed as a significant breakthrough

to boost the tumor treatment. Immunotherapy can cause severe side-effects including stomach sickness and skin blistering as sometimes healthy cells get attacked by the immune system. Therefore, researchers combined "fucoidan"-based magnetic nanomedicine with immunotherapy. The results proved that such combination successfully contains the cancer cells while boosting the growth of healthy cells, which in turn reduces the side-effects and increases the efficiency of treatment.

## Nanobots: The Emerging Era in Nanomedicine

There were several studies and experiments were performed on shrinking and adapting the conventional robots. Scientists succeeded in making them pretty small, but not in the range of nanoscale. The main obstacle was the powering source as they must be self-driven and never run out of power. Therefore, instead of solar powered, scientists equipped nanobots with radioactive material as it can sufficiently fuel them by decaying atoms. The primary material to manufacture nanobots is silicon as it has been the first choice in manufacturing delicate electronics. Moreover, silicon-based nanobots can last long, conduct electricity regularly, and flexible enough to manipulate in any way that is required. However, there are some downsides to the use of silicon. It is non-biodegradable. Manufacturing them on the large will drain natural resources. In addition, the recycling silicon is a long, complex, and most importantly costly procedure. However, there is research going on to create mechanical nanobots on the bacteria model. Bacteria are nothing but nanobots that are gone haywire. Scientists hope that the adapting bacteria can be converted into nanobots and eventually electrical components can be added to them, converting them into nanobots. To reduce the pollution and other side effects of nanobots, scientists are considering making at least partly biological nanobots.

## Pros and Cons of Nanobots

Nanobots serve as miniature surgeons, which can be used to repair damaged cells or entirely replace intracellular structures. Moreover, they can replicate themselves to correct the genetic deficiency or replace DNA molecule to eradicate the disease. Scientists claim that a fleet of nanobots can serve as antibodies or antiviral agents to treat patients with the impaired immune system. Research in nanobots can create lucrative opportunities in healthcare such as unblocking

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arteries or completely replacing a body organ. The conventional water-soluble drugs can create difficulties in the treatment such as failed absorption in the diseased areas. However, applications of nanomedicine such as diagnostic nanomachines provide the ability to monitor the internal chemistry of the body organs, providing direct access to diseased areas. Moreover, the technology such as nanobots can be equipped with wireless transmitters. This offers doctors opportunities to change the treatment method if the patient's medical condition gets worse. On the other hand, nanobots could be planted in the patient's nervous system to monitor pulse and brain-wave activities.

According to scientists, the nanobots could completely replace pacemakers by treating the heart cell directly. The research in nanobots offers several opportunities in future such as artificial antibodies, artificial white blood cells (WBCs) and red blood cells (RBCs), and antiviral nanobots. The major advantage that nanobots provide is that they are extremely durable. Theoretically, they can operate for years without any damage owing to their miniature size, which reduces mechanical damages. However, scientists are still working on the long-term effects of the use nanobots near the vital organs such as heart and liver. According to a study, the use of nanotechnology can cause

lung damages addressing the growing concerns regarding the safety of nanotechnology. However, the scientists also demonstrated how it can be combated by incorporating a Nano product that can protect against the lung cancer.

There are some other possible disadvantages of the use of nanobots that cannot be ignored. There is not a single technology that cannot be turned into a weapon of war. The nanobot-based war could be so lethal that today's bioweapons seem nothing but a common fever in comparison. The whole idea behind manufacturing nanobots is: "Make few and let them build themselves afterward". What if nanobots start to replicate uncontrollably? Instead of curing cancer cells, doctors will need to eradicate nanobots first. To overcome such likely disadvantages, several companies are investing more money in research and are not in hurry to launch new nanobots. Not long ago, Vancouver-based Company, Precision NanoSystems closed \$6 million-worth project to fund nanomedicine manufacturing platform, NanoAssemblr. The company is recognized for its research into the genetic basis of diseases and development in nanoparticle drugs. Such a strategic collaboration of leading companies and the infinite benefits of the use of nanobots have boosted the growth of the nanomedicine market, proving it the next big step in the nanotechnology and nanomedicine.