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# NANOMEDICINE- IT'S FUTURISTIC ROLE IN IMAGING, DRUG DELIVERY & TREATMENT OF CANCER

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## ABSTRACT

Nanomedicine is the medical application of nanotechnology. Nanotechnology could potentially bring benefits to many areas of life. The biological and medical research communities have exploited the unique properties of nonmaterial for various applications, like contrast agents for cell imaging and therapeutics for treating cancers. In a way biomedical nanotechnology can be considered as a hybrid field where nanotechnology is applied to a medical field. This article deals with possible futuristic applications of the nanotechnology in imaging and in drug delivery, to treat cancer.

***KEYWORDS:*** Nanomedicine, Nanoparticles in imaging, Nano drug delivery

## INTRODUCTION

Broad based application of nanoscale technology to practice of medicine is nanomedicine.[1] Super magnetic nanoparticles offer a high potential for several medical applications in gene therapy, drug delivery, magnetic resonance imaging [MRI]. This can change the medicine practice in future as far as diagnosis and treatment of diseases is concerned.[2]

There are speculations that field of molecular nanotechnology may revolutionise medicine by its application in the form of cell repair machines.[2] Billions of dollars are being invested worldwide for nanotechnology research and development[3] Two forms of nanomedicine are awaiting human trials to help diagnose and treat cancer and using lyposomes as vaccine adjuvants as a vehicle for drug transport.[4,5]

A benefit of using nanoscale for medical technology is that these smaller devices are less invasive and can possibly be implanted inside the body. These devices are faster and more sensitive than conventional drug delivery.[6]

## BIOMEDICAL APPLICATION OF NANOTECHNOLOGY IN DRUG DELIVERY

It is well known that many drugs while having a beneficial action can also exhibit deleterious effects that may limit their clinical utility. Drug used in cancer chemotherapy represent the clear example of this problems. These cytotoxic drugs can kill target cells, but also destroy normal cells in the body. Nanoscale particles can be used as a drug delivery system where the drug can be directed to a specific cell type to have a desired result.[7] Nanoscale particles improve bio-availability. Molecular targeting by nanoengineered devices improve drug bio-availability. It helps in targeting the molecules and delivering drugs with cell precision.[8,9] More than 65 billion dollars are wasted each year due to poor bio-availability. Use of targeting the molecules using nanoscale particles can save these wasted billions.[2]

## ROLE OF NANOPARTICLES IN IMAGING

By using nanoparticles contrast agent, images such as ultrasound and MRI have a favorable distribution and better contrast. This would help in obtaining better images and thus help in diagnosis. The small size of nanoparticles endows them with properties that can be useful in oncology, particularly in imaging. Nanoparticles with quantum confinement properties such as size-tunable light emission (Quantum dots) when used in conjuction with MRI can produce exceptional images of tumor sites. These nanoparticles are much brighter than organic dyes and only needs one light source for excitation. This means that the use of fluroscent quantum dots can produce a higher contrast image

and at a lower cost than today's organic dyes used as contrast media.[2]

**NANOPARTICLES IN CANCER TREATMENT**

Another nano property, high surface area to volume ratio, allows many functional groups to be attached to nanoparticles, which can seek out and bind to certain tumor cells. The small size of nanoparticles (10 -100 nm) allows them to preferentially accumulate at tumor site. If in future it becomes possible to manufacture multifunctional nanoparticles that would detect image and then proceed to treat tumor then this would bring new horizon to the understanding and treatment of cancer.[10]

A promising new cancer treatment that may one day replace radiation of chemotherapy is being edging closer to human trials. Kanzius RF therapy attaches microscopic nanoparticles to cancer cells and then kill the tumors inside the body with radiowave that heat only the nanoparticles of adjacent cancerous cells.[2]

Early detection and diagnosis of cancer from a few drop of patient's blood will be possible by using sensor test chip containing thousands of nano wires which will be able to detect proteins and other biomarkers left behind by tumor cells.[11]

Researchers at Rice University under Prof. Jennifer West, have demonstrated the use of 120 nm diameter nanoshells coated with gold to kill cancer cells in mice. The nanoshells can be targeted to bind cancer cells by conjugating antibodies or peptides to the nanoshell surface. By irradiating the area of tumor with an infrared laser, which passes through flesh without heating it, the gold is heated sufficiently to cause death to the cancer cells.[12]

In photodynamic therapy, a particle is placed within body and is illuminated with light from outside. The light gets absorbs by the metal particles. Particle and surrounding tissue get heated and destruction of the cancer cells is achieved.[2]

**CONCLUSION**

Apart from other applications, nanotechnology may play an important role in future medical practice, in diagnosis and management. Use of nanotechnology in MRI and drug delivery may offer high potential for diagnosis and treatment of cancer.

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