

# NANOTECHNOLOGY TO DESIGN PHARMACEUTICALS TO TARGET SPECIFIC ORGANS OR CELLS IN THE BODY SUCH AS CANCER CELLS, AND ENHANCE THE EFFECTIVENESS OF THERAPY

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DOI: 10.47750/pnr.2022.13.S01.170

## Abstract

The main objective of this specific case study is to discuss the usage of nanotechnology that helps in the treatment of cancer cells. This case study also includes how nanotechnology helps in the earlier detection of cancer cells in various organs in the body. The effectiveness of nanotechnology has also helped in the therapy that is necessary for the treatment of cancer. In the current days where the technology is very modern, doctors are also using these technologies to detect the disease in the human body and doctors are also taking help from these modern technologies to provide a perfect treatment to the victim or patient who has been affected by these diseases. The doctors are using magnetic resonance imaging or MRI for the detection of cancer cells and this also helps to give a proper treatment for this disease. In this case study a proper point has been described as the literature review and this part has some important points that are important for the analysis of this particular case study. There are different types of a tool that are based on the nanotechnology and help the treatment process of cancer. Basically, MRI and CT scan and other methods are used for the identification of the cancer affected areas but it takes a lot of time because low affected areas cannot be detected with the help of these techniques. Tools that are made on the basis of nanotechnology are used for the identification for these kind of malignancy. Biopsy is the most used method for the identification of the cancer cells as this is the most effective process for the identification of malignant cells.

## INTRODUCTION

Nanotechnology is a special branch in engineering that helps in developing various types of products that are very small in size but the effectiveness of these products are very efficient (Qin *et al.* 2021). Nanotechnology is used in parts of the modern living standards and it is mainly used in the medical services. This technology is used in the treatment of cancer cells and nanotechnology has effectively solved some of these complex medical cases very easily. Basically, nanotechnology helps to implement the chemotherapy in a direct method to the malignant cells of the body. Augmented radiotherapy is also a better application of nanotechnology that also helps in the treatment of cancer cells.

## NANOTECHNOLOGY IN TUMOR IMAGING

Nanotechnology is used as the proper treatment procedure for cancer affected patients, there are many diagnostic tools that are used in the detection of this disease (Wang *et al.* 2019). There are also therapeutic strategies and various types of cancer detection diagnostic procedures that help to put a stop to the growth and spread of cancer cells. The important tools that are used for the cancer detection are like Positron emission tomography, computed tomography and ultrasound method but the main problem of using those techniques is the cancer affected area must be matured enough so that it can be diagnosed easily.

The imaging of the malignant tumor with the help of nanoparticles has helped the doctors to identify the position of the malignant tumor and also it helps to detect whether the tumor is malignant or not (Barani *et al.* 2021). This is also helpful for the doctors to detect the malignant tumor in the early stage. The SPIONs technique is also using nanotechnology and according to the recent case studies it proves that the SPIONs has no side effects. For this reason, SPIONs technique is important for the treatment of lung cancer as it is used as the building blocks for the aerosols (Osial *et al.* 2018). Magnetic powder is another treatment tool of cancer that uses high resolution which are very much sensitive for the cancer cells. This tool is also used in the nebulization method of lungs and this tool is made of magnetic nanoparticles.

**Table 1:** Drugs for cancer treatment

Type of cancer	First line drug	Second line drug
<b>Leukemia</b>	<b>Daunorubicin, Cyclophosphamide</b>	<b>Cytarabine</b>
<b>Lymphoma</b>	<b>Vinblastine, cyclophosphamide</b>	<b>Doxorubicin</b>
<b>Esophagus</b>	<b>Doxorubicin</b>	<b>Carmustine</b>
<b>Carcinoma</b>	<b>Cyclophosphamide</b>	
<b>Prostate</b>	<b>Bicalutamide Gonadotropin</b>	<b>Cisplatin</b>
<b>Breast</b>	<b>Tamoxifen, Methotrexate</b>	<b>Prednisolone</b>
<b>Cervix Carcinoma</b>	<b>Mitomycin C</b>	<b>Lomustine</b>
<b>Colon Cancer</b>	<b>5-FU</b>	<b>Leucovorin</b>
<b>Bladder</b>	<b>Vinblastine</b>	<b>Cisplatin</b>

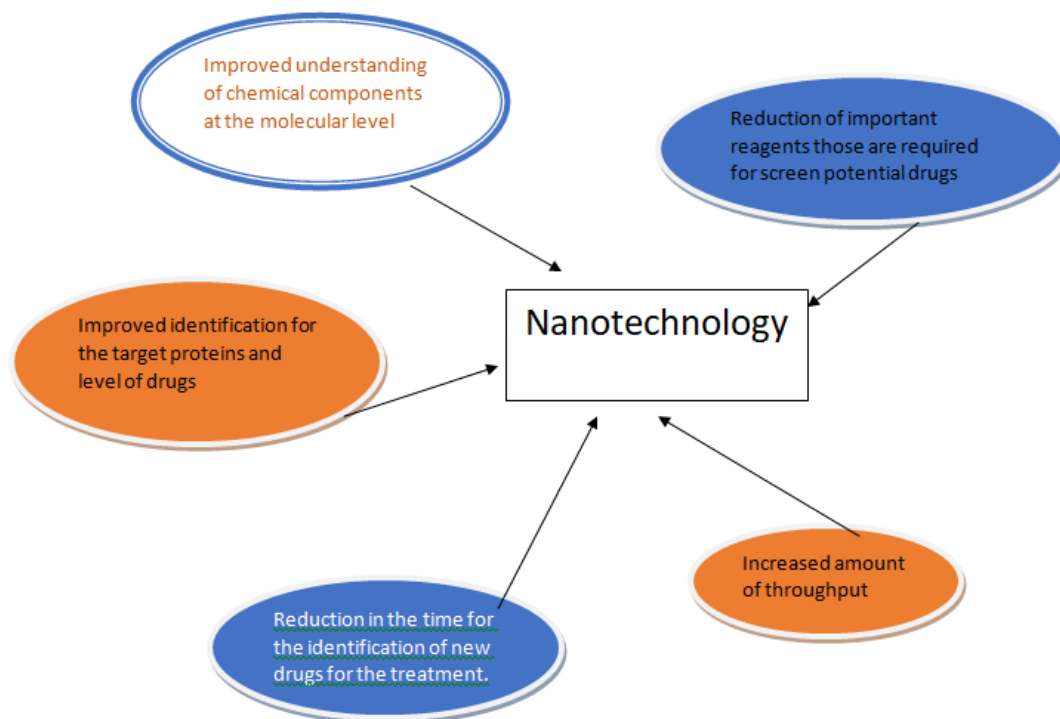
(Source: Conlon *et al.* 2019)

There are various types of cancer that can affect a person and for the treatment various types of drugs are used. For the treatment of leukemia, Daunorubicin, Cyclophosphamide are used as first line drugs and for the treatment of lymphoma, Vinblastine, cyclophosphamide are used as the first line drugs (Conlon *et al.* 2019). Cytarabine is the second line drug for the treatment of leukemia. On the other hand, for the treatment of Oesophagus, Doxorubicin is used and Carmustine is used as the second line drug for the treatment of cancer.

## EFFECTIVENESS OF DRUGS FOR CANCER THERAPY

Dendrimers are the nano sized products that have a structure of branch like and this an unique pattern helps this to cover a larger area. On the other hand, the shape and size can be changed later as per the requirements (Chis *et al.* 2020). These are one of the most optimal systems that generally carries the anti cancer drug to the target spot without facing a problem. Not only are this, the nano emulsions are the proper emulsions that are based on the oil in water emulsion and the size of the droplets from 50 to 1000 nm.

**Figure 1:** Application of nanotechnology



(Source: Pillai, 2019)

The above figure helps to discuss the affectivity of the nanotechnology in the field of medical and this also helps to describe the effectively of nanotechnology in the treatment process of cancer (Pillai, 2019). Important points that are based on the nanotechnology are- Improved understanding of chemical components at the molecular level, reduction of important reagents those are required for screen potential drugs. On the other hand, there is improved identification for the target proteins and level of drugs, improved understanding of chemical components at the molecular level and also increased amount of throughput.

## METHODOLOGY

The methodology is one of the most important parts that helps to analyze the main objective of the research topic. This also helps the researcher to critically evaluate the importance of the case study. This part of methodology can be divided into various types of research philosophy. Important research philosophy contains positivism, interpretivism and realism. Positivism philosophy can be achieved by either the quantitative method or by qualitative methods. The positivism research methodology

is generally based on real life data and information. In this case study, **positivism research methodology** has been used to discuss the importance of nanotechnology in the field of medical science (Bleiker *et al.* 2019). The research approach is another important aspect of the research topic that helps to increase the relevance of the particular research topic. In the process of analyzing a scientific research topic, the research approach is very important. These research approaches can be divided in three parts and these are inductive, deductive and adductive. The inductive research approach is generally based on the qualitative data collection methods and the deductive research approach is based on the quantitative method of data collection.

On the other hand, the adductive research approach consists of both the qualitative and quantitative methods that are necessary for the analysis of a scientific research topic. In this particular case study of discussing the effectively of nanotechnology on the treatment for cancer, the **deductive research approach** has been selected because this is the most suitable research approach for the research analysis for this case study. **Secondary data collection method** has also been selected for the analysis of this particular case study (Sarkar *et al.* 2020). The research design is one of the most important techniques that has helped in the analysis of this research topic. This also helps to increase the significance of the particular case study and there are various types of research design. These are like descriptive research design, explanatory research design, co relational research design, experimental research design and also diagnostic research design. The descriptive research design helps to describe all the important facts and cases that are associated with the research study. The **descriptive research design** has been chosen as the most suitable research design method for this specific research study. On the other hand, a thematic analysis has also been included in this particular research topic of importance of nanotechnology in the treatment of cancer.

## Findings

### Implementation of nanotechnology in cancer treatment

Cancer generally happens due to the abnormal growth of the body cells and everyone has a possibility to be a victim of cancer. The cancer cells are also known as malignant cells and for the treatment of cancer, nanotechnology has helped the doctors a lot (Enrico, 2019). Nowadays doctors are using MRI, CT scans to detect the cancer cells in various parts of the body. On the other hand, the main problem with these methods, doctors can only detect the malignant cells when these types of cells have grown big enough. So, this takes a lot of time to detect the cancer cells and during this long time period the cancer cells can spread into different parts of the body because these types of cells are able to duplicate themselves in a very short time period. Sometimes doctors find tumors in the different parts of the buddy organs but the doctors have to be assured that these tumors are carrying the possibility of being malignant.

The normal scans or MRIs cannot detect these malignant tumors in time and that is why biopsy is used for better detection for these malignant tumors and cells. Biopsy is generally used to remove any malignant cell or body fluids for the deception and examination (Drost *et al.* 2019). After that the sample of the cell or body fluid is taken and sent to the diagnostic laboratory for the examination. The report that is based on the sample, describes whether the patient is affected by the cancer cells or not. Biopsies are done to diagnose some symptoms including inflammatory disorder in the liver that is also known as hepatitis, various types of immune disorders like chronic pancreatitis and also in different types of infections like tuberculosis (Heidrich *et al.* 2021). Nanotechnology helps in the treatment of most of the critical diseases.

### Early detection and diagnosis

The battle against cancer can be easily won by the earlier detection of this disease because in most of the cases the condition of the patient becomes so serious. On the other hand, the malignant cells are transitive and these cells can divide and replicate themselves in a very short period of time (Lopes *et al.* 2019). For this reason, the diagnosis and detection is to be done in a short span of time otherwise the condition of the patient will go extremely wrong. Nanotechnology is being used by the doctors that actually help to enable the imaging in Vivo and this helps the doctors to identify the pattern of the tumor, whether it is malignant or benign. The nanotechnology also helps to enable the vitro diagnostic devices that help to detect the malignant tumors with more efficiency.

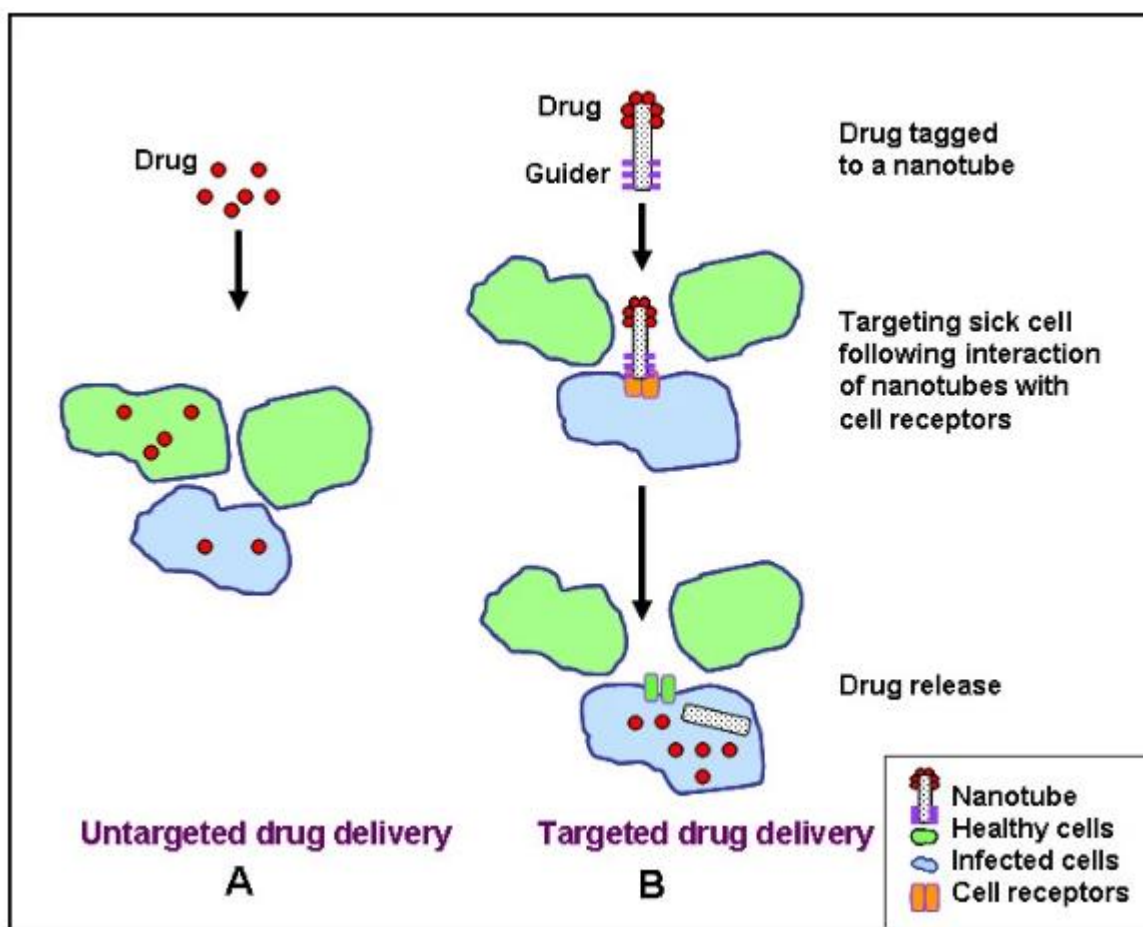
There are various types of devices that help to early detect those cancer cells in the body organs. Lithography is one of the most important ways of treatment that is helpful for the patient of cancer (Cox *et al.* 2020). Biosensor is a device that is based on nanotechnology that helps to detect the presence of any biochemical molecule in a solution that has been taken for the examination. On the other hand, there are various devices that also uses the nanotechnology like the bio-barcode that also uses

the magnetic nanoparticles. Diagnostic Magnetic Resonance or DMR sensors were built by the Massachusetts General Hospital and this helps to explain the transverse relaxation signal of water.

### Impact of nanotechnology to design pharmaceuticals

Nanotechnology has another application on the drug delivery system to a specific body part. A body part that is affected by any disease and in that case the particular organ is to be treated and other body parts should not face any side effect that can occur by the specific drugs. For this reason, the doctors have to identify the organ that is the victim of that disease. After the identification of the disease the doctor provides some medicines that consist of various types of drugs (He *et al.* 2019). Sometimes the drugs have to be targeted to the affected organ and in this case the doctors use these drugs in a capsule that is made of polypeptides. In this case of targetive usage of medicines and drugs, the capsule of polypeptide becomes melted while it comes in touch of the fluids that are present in the liver. In that way, the drugs present in the capsule affect the targeted body organ and it helps not to make any impact on the other organs. This kind of facility can only be achieved with the help of using nanotechnology.

**Figure 2:** Target drug treatment and function of capsules



(Source: He *et al.* 2019)

In this above-mentioned picture, it can be easily explained that picture A represents the non targeted drug delivery to a particular body organ and picture B also represents the targeted drug delivery to a specific organ.

## CONCLUSION

After discussing all the above points that are necessary for the analysis of nanotechnology, it will be easier for anyone to say that nanotechnology is one of the most important tools in the field of medicine. The technologies that are required for the betterment of the treatment of cancer, nanotechnology helps to provide them all. This also helps to detect the cancer affected area in the early stage, the possibility of the survival of the patient that is effected by the cancer will be increased if the diagnosis happen in time. Nanotechnology not only helps to detect the cancer affected part of the body, but this also helps in the treatment of the patient. Nanotechnology has another application on the drug delivery system to a specific body part. Cancer generally happens due to the abnormal growth of the body cells and everyone has a possibility to be a victim of cancer. Dendrimers are the nano sized products that have a structure of branch like and this an unique pattern helps this to cover a larger area. There are also therapeutic strategies and various types of cancer detection diagnostic procedures that helps to put a stop to the growth and spread of cancer cells.

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