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(REVIEW ARTICLE)

A review: Nanorobotics in cancer therapy

Aafhtabkha Aniskha Pathan [1,*] and Swati P. Deshmukh [2]

[1] *Department of pharmacy, Shraddha institute of pharmacy, Washim, (MS) India 444505.*
[2] *Department of pharmacology, Shraddha institute of pharmacy, Washim, (MS) India 444505.*

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Abstract

This review paper aims at presenting the overall nanorobotics of the present trends and advancements development in treatment of cancer. Nanorobotics have mainly use such as ability to find out and destroy the cancer cell. In addition to it's significant impact in medicine, nanotechnology has also been shown to be useful in early diagnosis and treatment. Nanorobotics have the potential to increases the selectively and potency of chemical, physical and biological processes to kill cancer cells while minimizing toxicity to non-cancerous cells. The main focus on the application of nanorobotics in diagnosis and treatment of some diseases like cancer, heart diseases, diabetes, kidney diseases etc. Nanorobotics are performing task like moving, informed, signalling, information processing and intelligence at nanoscale. This review focuses current therapy of cancer cells and description of nanorobotics including it's parts, application and nanorobotics in cancer treatment.

Keywords: Nanorobotics; Cancer; Cancer therapy; Nanotechnology; Stem cells.

1. Introduction

The word" nano" originates from the Greek word" dwarf" The conception of nanotechnology was first developed in 1959 by Richard Feynman, a Nobel Prize winning physicist, in a lecture named," There is plenitude of room at the bottom".' He ended the lecture concluding" this is a development which I suppose cannot be avoided!". Since also, nanotechnology has set up use in a myriad of operations including dental opinion, material and rectifiers. The term nanotechnology was chased by a pupil at a Tokyo wisdom university in 1974.

Nanotechnology is the study, design, creation, synthesis, manipulation and use of materials, materials and technology at the nanoscale (one meter consists of one billion nanometers). Nanotechnology is best defined as the description of activities at the atomic and molecular level that have real-world applications. A nanometer is one billionth of a meter, approximately 1/80,000 the diameter of a human hair, or 10 times the diameter of a hydrogen atom. The application of nanotechnology in medicine has attracted great attention in recent years. Nowadays, there are many treatment methods that are very time-consuming and also quite expensive. Faster and cheaper treatments can be developed using nanotechnology.

Nanorobots are nanodevices used to prevent or treat human diseases. It is a small device designed to perform a specific function, or sometimes a negative function, at the 1-100 nm nanoscale. They hope to work in the molecular and cellular environment to accomplish tasks in medicine and manufacturing. The main element used in nanorobots is carbon, and since carbon has inertness and durability in the form of diamond and fullerenes, nanorobots have an external passive diamond layer specifically to prevent attack by the host's immune system. They are invisible to the naked eye, making them difficult to manipulate and study with techniques such as scanning electron microscopy (SEM) and atomic force microscopy (AFM).

* Corresponding author: Aaftab Khan Anis Khan Pathan

The main important aspects of nanorobotics in cancer therapy be used to recognize and destroy cancer cells, nanorobotics with chemical biosensors can be used to perform detection of tumour cells in early stages of development inside the patient's body.

- Nanorobots destroyed cancer cells in the body.
- Removing blockages in blood vessels.
- Replace DNA Cells.

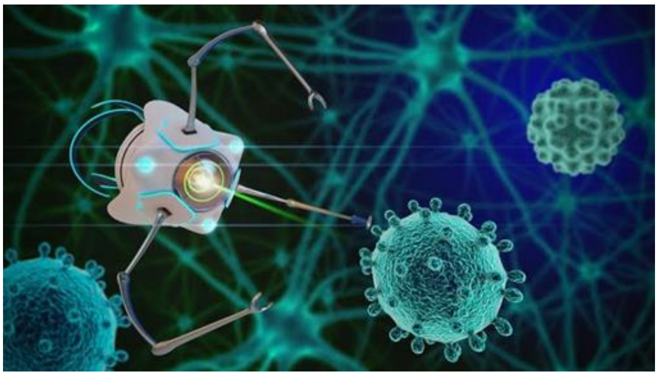

Figure 1 Nanorobotics

2. Cancer

Cancer is a terrible disease that affects both rich and poor. It is said that Hippocrates called this disease, which is seen in adults and children, "cancer". According to his theory, there are four fluids in the body. That is, blood, phlegm, yellow bile and black bile. Increased black bile can lead to cancer. Researchers concluded that changes in people's lifestyle, diet, environment and the development of many businesses cause cancer by increasing radiation and carcinogens. Apparently, it can cause cancer. Alcohol, smoking, obesity, age, hormones and chronic diseases can also cause disease. This is the main goal of nanotechnology, in which drugs are designed to distinguish cancer cells from healthy cells and thereby reduce their growth and development. But in this case, chemotherapy always fails.

Cancer may be localized or may become systemic if conditions favourite It is becoming very common in the recent years and has caused millions of deaths. Cancer is next only to cardiovascular diseases in causing death to humans globally Yet, there is no proper and adequate medication for its Estimation says irrespective of gender, about 38.5% of people in the world are affected by cancer at some point in their lifespan.

The Table 1: Worldwide cancer statistics by decade. It is estimated that 13.1 million people will die from cancer by 2030. From all these statistics, it can be concluded that cancer in men and cancer in women are the most common cancers in the world. We are talking in India. While men suffer from breast cancer and lung cancer, women are more likely to suffer from breast cancer, stomach cancer and breast cancer. Compared to white men, black men are twice as likely to die from cancer. Although white women are more likely to get breast cancer, black women have the highest death rate.

Table 1 Global cancer death statistics

Year	Cancer death (millions)
2000	6
2002	6.7
2008	7.6
2012	8.2
2015	8.8

Approximately 60% of cancer patients are treated with radiotherapy or chemotherapy or a combination of both The primary aim of these therapies is to kill the cancerous cells. However, the surrounding healthy cells also get affected.

The key problem with these radio and chemotherapies is not that the drugs are not effective, but that the rest of the body cannot tolerate the high drug concentration. Some infections by carcinogenic viruses can be prevented by vaccines (such as human papillomavirus vaccine which prevents cervical cancer, the most common one among Indian women), but there are still many types of cancers affecting trillions of people which cannot be easily cured.

3. Current therapy of cancer

Among the problems of cancer, resistance to drugs and their delivery systems is the biggest problem in treating and reducing the signs and symptoms of cancer, but many recommendations and medications are now available. The effectiveness of cancer treatment decreases due to abnormal tumor pathology and tumor vascular pattern.

The following are the advanced and innovative cancer therapy types with their benefits and challenge.

- Stem cells therapy
- Pluripotent stem cells
- Adult stem cells
- cancer stem cells

3.1. Stem cells therapy

Stem cells are undifferentiated cells found in the bone marrow (BM) that have the potential to differentiate into any type of body. Stem cell therapy strategies are also considered safe and effective in cancer treatment. Stem cell applications are still in the clinical trial phase. For example, their use in the regeneration of other damaged tissues is being investigated. Mesenchymal stem cells (MSCs) are currently being used in BM delivery trials. Adipose tissue and connective tissue.

3.2. Pluripotent stem cells

Embryonic stem cells (ESCs), isolated from the homogeneous inner cell mass of the embryo, have the flexibility to produce any or all cell types other than cells in the placenta. In 2006, Yamanaka's discovery of properties capable of inducing pluripotent stem cells (iPSCs) from human cells in culture resulted in a revolution in cell biology. 17 To avoid ethical issues arising from embryo damage, iPSCs and ESCs are cocultured. Hematopoietic embryonic stem cells (hESCs) and iPSCs are currently used to stimulate effector T cells and natural killer (NK) cells 18 and to prepare antibodies.

3.3. Adult stem cells

Adult stem cell (ASC) populations commonly used in cancer therapy include hematopoietic stem cells (HSC), mesenchymal stem cells (MSC), and neural stem cells (NSC). body. Currently, only the U.S. Food and Drug Administration (FDA) approves the injection of cord blood hematopoietic stem cells to treat multiple myeloma and leukemia. 20 Mesenchymal stem cells are found in many tissues and organs and play an important role in tissue repair and renewal of cells such as bone cells, adipocytes, and chondrocytes. MSCs have unique biological properties that can be used as an adjunct to other tumor therapies. 21 NSCS can self-renew, generate new neurons and glial cells, and can be used in the treatment of breast cancer, metastatic and other tumors.

3.4. Cancer stem cells

Cancer stem cells (CSCs) are generated through a process of epigenetic modification in normal stem cells or precursor/progenitor cells. Its roles in cancer treatment include cancer growth, metastasis, and recurrence, and thus may be promising for cancer treatment. 23 Stem cells have many functions in tumor treatment. Homing is a process in which HSCs rapidly migrate to stem cell niches in the BM, followed by engraftment of the graft and subsequent production of specialized cells. This process relies on the interaction of stem cell CXCR4 receptors and requires their interaction with endothelial cells via LFA-1, VLA-4/5, CD44, and the release of matrix-degrading enzymes (MMP-2/92). The second mechanism is the tumor tropism effect, in which mesenchymal stem cells migrate and migrate into the tumor microenvironment (TM) attracted by CXCL16, SDF-1, CCL-25, and IL-6 secreted by tumor cells. TM) causes tumor stroma development by causing differentiation. all kinds of blood.

Table 2 Licensed stem cell therapies

Sr. No.	Stem cell therapies	Examples	Authority	Indication
1	Pluripotent stem cells	iPSC (sipuleucel-T)	FDA	Prostate cancer
2	Adult stem cells	MSC-INF - β	FDA	Ovarian tumor
3	Cancer stem cells	Venetoclax	FDA	AML

AML: acute myelogenous leukemia; FDA: The US Food and Drug Administration, iPSC: induced pluripotent stem cell, MSC-INB: mesenchymal stem cells with interferon beta.

4. Role of Nanorobotics in other diseases

4.1. Role of Nanorobotics in diabetes diseases

Nanorobots are thought to have new health potential in improving medical equipment, diagnosis and treatment of diabetes. Diabetics need to have small blood tests several times a day to control their blood sugar; This is a very uncomfortable and laborious process. To prevent such problems, medical nanorobots can be used to monitor glucose levels in the body by constantly monitoring blood sugar levels.

A simulated nanorobot model embedded with complementary metal oxide semiconductor (CMOS) nanobioelectronics. Its size is -2 microns, allowing it to circulate freely in the body. The nanorobot uses an embedded chemical sensor that controls the hSGLT3 protein glucose sensor activity. By looking at its chemical properties, the nanorobot can determine whether the patient needs an insulin injection or something else. They flow through the blood with red blood cells to control the glucose level. At high glucose levels, the nanorobot tries to control blood sugar around 130 mg/dl according to the blood sugar level (BGLS) target. In medical nanorobot architecture, important measurement data can be sent to the mobile phone carried by the patient via radio frequency. At any time when the sugar reaches a critical level, the nanorobot will give a sound alert to your phone.

4.2. Nanorobots in heart attack prevention

Nanorobots can also be used to prevent heart-attacks. Heart-attacks are caused by fat deposits blocking the blood vessels Nanorobots can be made for removing these fat deposits The nanorobots remove the yellow fat deposits on the inner side of blood vessels. This will allow for both improving the flexibility of the walls of the arteries and improving the blood flow through them)

From this hypothesis, such technology will help for delivery of drugs like lipid lowering substances such as lovastatin, simvastatin etc. These drug molecules will enter with nanorobots and give delivery at the site of action.

4.3. Nanorobots in kidney disease

Nanorobot destroys kidney stones with the help of ultrasonic shocks Kidney stones are painful and large stones do not pass through the urine. Sometimes doctors use ultrasonic frequencies to break the stones, but these are not always the case. Nanorobots use tiny lasers to destroy kidney stones, and the tiny particles are excreted in the urine.

4.3.1. Cleaning wounds

Nanorobots can help remove debris from wounds and reduce the risk of infection. They are particularly useful in the case of blade piles that are difficult to straighten using various rules.

5. Role of Nanorobotics in cancer

Cancer could be defined as the group of diseases characterized by the uncontrolled growth and spread of abnormal cells in the body is what defines cancer, and the number of individuals affected each year continues to climb . Cancer takes the first place in the research due to its effect of human life and its cost to the economy Conforming to the Global Oncology Trend Report, by the IMS Institute for Healthcare Informatics, global spending on cancer medications has reached to $100 billion in 2014.

Cancer treatment will be the main reason for the development of nanorobots, with the help of nanorobots, cancer can be treated effectively using existing medical equipment and medical equipment. To determine the prognosis and survival of a cancer patient, the time of disease transformation can be determined at the time of diagnosis, and a positive diagnosis can be made again if it is the first. Drug distribution to reduce the cost of treatment.

Considering the properties of nanorobots to navigate as blood borne devices, they can help important treatment processes of complex disease in early diagnosis and amor drug delivery A nanorobots can provide an efficient early diagnosis of cancer and help with smart chemotherapy for drug delivery. Nanorobots as drug carriers for timely dosage regimens allows maintaining the chemical compounds for a longer time as necessary into the bloodstream circulation, providing predicted pharmacokinetic parameters for chemotherapy in anticancer treatments.

6. Types of nanorobots

Some researchers classify nanorobots in drug delivery and therapeutics according to the their applications, which are described below.

- Pharmacyte
- Diagnosis and Imaging
- Respirocyte
- Microbivores
- Clottocytes
- Chromallocyte

6.1. Pharmacyte

It is a 1-2 µm long medical nanorobot that can carry 1 µm3 of the drug administered into the tank. They are controlled by the use of the pump. It is equipped with molecular markers or chemotactic sensors that guarantee complete accuracy. Oxygen obtained from the local environment such as blood, gastric fluid, and cytoplasm is the energy of the ship. Once the nanorobot has completed its work, it can be removed or recycled via centrifugal nano separation.

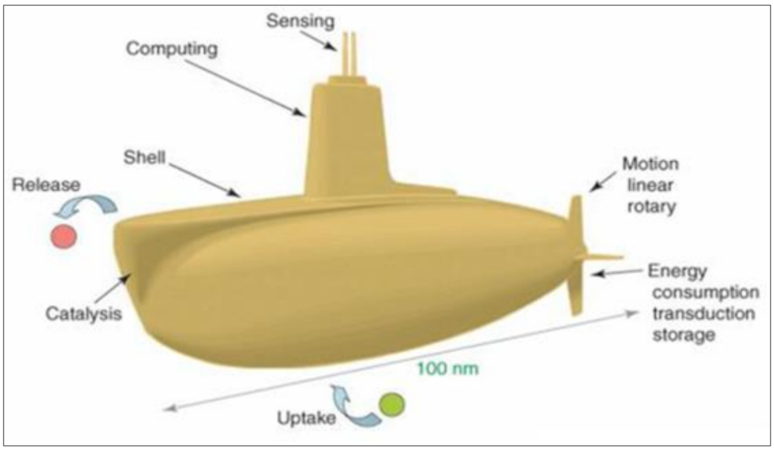

Figure 2 A Fictitious pharmacyte

6.2. Diagnosis and Imaging

They have microchips that are overlaid with human molecules The chip is projected to send an electrical signal when the molecules detect a disease Gives an example of special sensor nanobots that can be introduced into the blood under the skin where they verify blood contents and notify of any possible diseases. They can also be used to monitor the sugar level in the blood. Advantages are the low price to -produce and easily to manipulate.

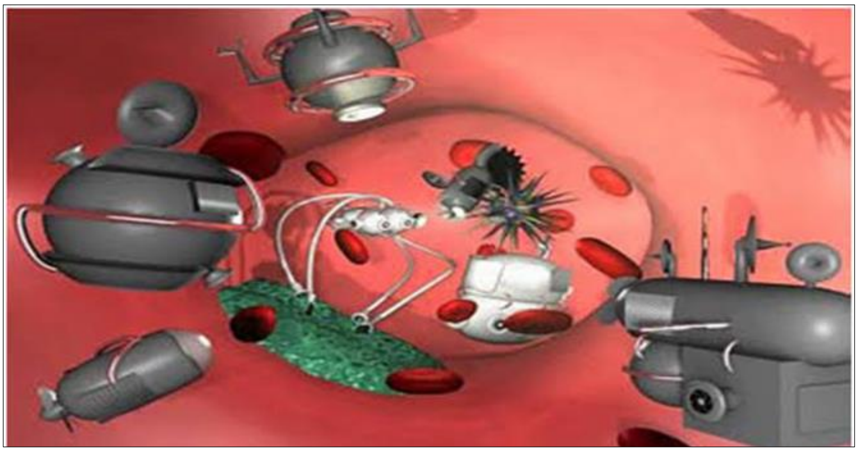

Figure 3 Nanorobots in blood vessels for diagnosis and imaging

6.3. Respirocyte

It is an oxygen-carrying nanorobot that expresses red blood cells. Energy is obtained from endogenous serum glucose. Progenitor cells deliver 236 times more oxygen and acid to tissues per unit volume than RBCs (red blood cells).

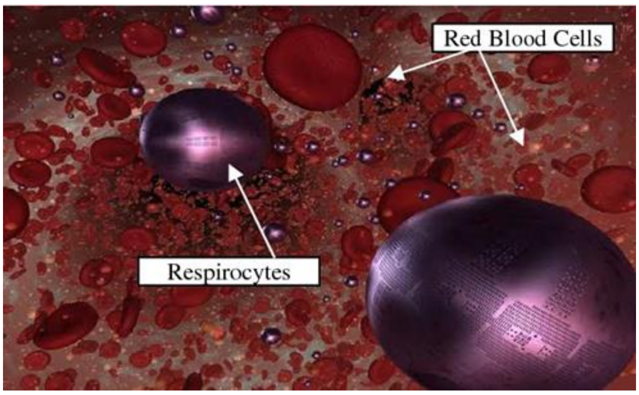

Figure 4 Respirocyte

6.4. Microbivores

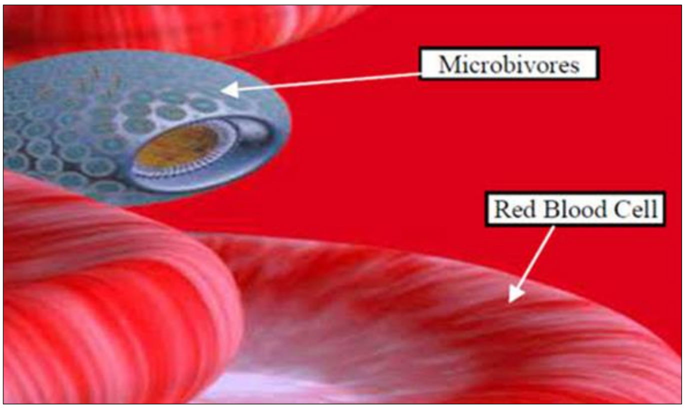

Figure 5 Microbivores

It is a flat spherical device for nanomedicine applications, with a major axis diameter of 34 μm and a minor axis diameter of 2.0 m. Nanorobots can continuously use up to 200 pW of energy, which is used to digest captured bacteria. Another special report mentions the ability of phagocytic cells to approximately 80 times outnumber macrophage workers in terms of volume digested per unit volume/second.

6.5. Clottocytes

This is a nanorobot with a unique and fun ability that can use blood clots or artificial devices to "instantly" stop bleeding. As we all know, platelets are spherical, nucleated blood cells with a diameter of 2 microns. Platelets bind to the bleeding site: here they strengthen, become sticky, and combine to form a cushion that helps close the blood vessels and stop bleeding. bleeding. They also prescribe medications that help blood clot.

6.6. Chromallocyte

The Chromallocyte would replace entire chromosomes in individual cells thus reversing the effects of genetic disease and other accumulated damage to our genes, preventing aging Inside a cell, repair machine will first size up the situation by examining the cell's contents and activity, and then take action by working along molecule-by- molecule and structure-by structure, repair machines will be able to repair the whole cells.

7. Structure and design of nanorobots

The components of nanorobots are made of carbon and use diamond or fullerenes because it is inert and strong. Other materials used at the nanoscale are hydrogen, oxygen, nitrogen, sulfur, silicon, fluorine, etc. The features of nanorobots are as follows,

- **Medicine cavity:** This is a hollow section in nanorobots used to hold small drugs inside the robot, which can deliver drugs directly to the site of injury or infection.
- **Probes, knives and chisels:** These probes, blades, and chisels are used to remove plaque and blockages. These help nanorobots process and destroy information. They may also need a device to break the blood vessels into smaller pieces. If part of the artery breaks and enters the artery, this can cause further problems in the artery.
- **Microwave emitters and Ultrasonic signal generators:** They are used to destroy cells (such as cancer cells) before they burst. Nanorobots can destroy chemicals in cancer cells using the right microwave signal. Kill the walls of the hand without damaging them. Alternatively, the robot can emit microwave or ultrasound signals to heat cancer cells enough to destroy them.
- **Electrodes:** Nanorobots use electrodes to generate electric current that heats cells until they die or destroy.
- **Lasers:** Lasers are used to burn harmful materials like cancerous cells, blood clots and plaques 1.e. these lasers vaporize tissues. With the help of powerful laser vaporizing cancerous cells in the challenging work, but this laser does not harm to surrounding tissues.
- **Power supply for nanorobots:** Of course, the most important thing about nanorobots is energy. Nanorobots need electricity to do all the work they need. There are two ways to do this. The first is to obtain the power from a source within the body, either by having a self-contained power supply or by getting power from the bloodstream.
- The second possibility is to provide the body with energy coming from outside.

8. Advantages of nanorobots

- Use of nanorobotic drug delivery systems with higher bioavailability.
- Only for therapeutic purposes such as the treatment of malignant diseases;
- Reach remote parts of the human body that surgeons cannot reach;
- Since drug molecules are transported by nanorobots and release the desired one, the wide interface area is utilized during mass transfer.
- Automated technology
- Through computer control, efficient output volume, frequency and time buttons.
- Accuracy is higher.
- Drugs do not work in areas that do not need treatment, minimizing side effects.
- Small. The size limit of nanorobots is 3 microns, which allows them to flow easily through the body without clogging blood vessels
- Cost-effective (if mass-produced, batch processing production is low-cost, even if the initial cost of installation is still very high!"

9. Conclusion

As mentioned above, the development and use of nanorobotics in cancer treatment has become an active area of research. To realize the potential of nanorobots in cancer treatment, data and intelligence scientists need to work on drug delivery, medical care, etc. It should work with medical scientists to conduct research on the behavior and function of nanorobots, including Treatment, minor surgery, cancer diagnosis and early diagnosis and other advanced nanorobot assisted treatment. Considering the recent results obtained in vivo and in vitro experiments, researchers should study the needs and problems of oncologists and develop cancer nanorobots/nano submarines for specialized diagnosis designed or modified to accelerate nano-robotics/nano-submarine cancer research into real-world clinical applications.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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