Review Article

Nanorobots is an Emerging Technology Which is Helpful in the Diagnosis and Treatment of Various Diseases

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ABSTRACT

This review is provided detailed overview of the types, properties and application of nanorobot in the diagnosis, prevention and treatment of various diseases. Now a day's health care industry focusing on the development of nanotechnology for the diagnosis and treatment of various diseases. Development of nanorobots is an interesting and hopeful area of nanotechnology which is produce on nanoscale. Many drugs exhibit is the problem of less bioavailability of drug and require the administration of higher amount for treatment of various diseases. To overcome such problem, nanorobot are the novel solution that deliver the drug to the target thus small dose is sufficient to achieve the desired therapeutic effect. Nanorobots are tiny device which is measure on the nanometer scale. Nanorobots also known as nanite, nanobots, or nanomites. Nanorobots are used in the diagnosing, treatment and prevention of the diseases, relieving pain and improving the human health.

Keywords: Nanorobots, Bio-Nanorobot, Nanobots, Nanite, Nanomites

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INTRODUCTION

There is a growing interest and medical need for the improvement of bioavailability of the drug. The drugs which are less bioavailable in the systemic circulation needs administered at higher doses but only the small amount of drug is absorbed in the systemic circulation and reach the target site. Therefore, a large amount of the drug is wasted and the unabsorbed drug leads to an unwanted side effect. Nanorobots are one of the solutions to overcome the above-mentioned problem and to achieve this targeted and controlled drug delivery.[1] Nanorobots comprises of two words nano and robots. Nano means very small, it is measure in nano second and Robots means machine which may be operate by programming.[2]

Nanobots are a nano robot device also known as nanite, nanobots, or nanomites. It is electromechanical/ mechanical device is used to measure the dimension in form of nanometer. Its range is up to 1000nm.[3] It is made like smart structure which is capable of actuation, sensing, signaling, and information processing at nano scale (10-9 m). Bio nanorobots are a nanobots which are developed by applying properties of biological materials (peptides, DNAs). By the use of nanorobots most of the problem can be is solved such as.[4] Nanoids which contain self-regulating nanomotors and it is biodegradable nanodevices products of bio-nano parts that deliver medicine on the target sites.[5] Experts acknowledge that the somewhat speculative statements regarding the feasibility of utilizing nanorobots in medicine will completely revolutionize the world of medicine if they are realized. Nanomedicine would employ these nanorobots (e.g., Computational Genes) to heal or identify damages and illnesses in the body. A typical blood-borne medical nanorobot would be between 0.5-3 micrometers in size, according to Robert Freitas of the Institute for Molecular Manufacturing, because that is the greatest size attainable due to capillary passage requirements. Due to the inherent strength and other qualities of specific kinds of carbon (diamond/fullerene composites), carbon might be the principal element utilized to make these nanorobots, and nanorobots would be fabricated in desktop nano factories dedicated for this purpose. As ^{13}C possesses a nonzero nuclear magnetic moment, nanodevices may be seen working inside the body using MRI, especially if their components were made largely of ^{13}C atoms rather than the normal ^{12}C isotope of carbon. Medical nanodevices would be administered into a human body before being used in a specific organ or tissue mass. The doctor will keep track of the progress and ensure that the nanodevices are being delivered to the correct therapeutic area. The clinician will also be able to scan a region of the body and see the nanodevices neatly clustered around their target (a tumor mass, for example) to ensure that the surgery was effective.

The development of nanobots for the purpose of diagnosis and treatment of the diseases by accumulating the data from the human body. Now a days nanomedicine are regarded as a – direct drug delivery on the specific target, improve artificial immunity, and carry out easily surgery

with minute cut. Nanobots are also used to easily disperse the vaccine throughout the body.[6] Medical nanobots plays vital role in diagnosis and treatment of diseases such as diabetes, cancer, cellular nano surgery and genethearapy.[7]

The design of the nanorobots is based on biological models of bacteria. Carbon is the main material used in the construction of the nanorobot and is composed either in the form of a diamond/diamondoid (including pure diamond and crystalline allotrope carbon) or fullerene nanocomposites. A nanorobots are made of mechanical components such as bearing, gears, motors etc. The outer shell of the nanorobot is constructed using a diamondoid material due to its inert properties, high thermal conductivity and strength. More smooth surfaces can reduce the chances of triggering the immune system. Nanoscale gears and other specialized devices can be constructed using materials such as hydrogen, sulfur, oxygen, nitrogen, silicon etc.[8] Nanobots requires motor for moving purpose it also required power supply sensor for control its behavior. Nanobots are smaller than the red blood cell which have capability to move through body's narrow capillaries. A surgical nanorobots is operated by human surgeon to execute surgery on individual cell.[9]

Development of nanorobots is an interesting and hopeful area of nanotechnology.[10] The first study of nanobots was carried out by Robert Freitas. This on study associated with respirocytes similar to that of blood cell.[11] The term nanotechnology was introduced by Professor Kerie E. Drexler, a researcher and writer of nanotechnology. Processes for making metal, burning rubber, and sharpening dental instrument all depend on the manipulation of nanoparticles. Richard Zsigmondy studied nanomaterials in the early 20th century, and his findings later became theories presented by Nobel Prize-winning philosopher Richard Feynman in a speech entitled "Plenty of Room at the Bottom" in 1959, in which he examined the effects of matter of manipulation. Applications began in the 1980s with the invention of the scanning tunneling microscope and detection of carbon nanotubes and fullerenes.[12] Nanorobots due to their unique physical chemical and mechanical property have applications in the in the diagnosis and treatment of various neurological diseases such as Alzheimer's, Parkinson and cancer etc.

In this review article, we provide a general overview on the types of advantage, disadvantage characteristics and applications of nanobots in the diagnosis, prevention and treatment of various diseases.

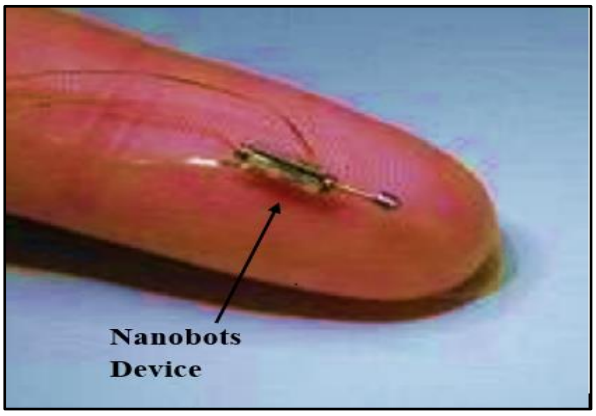


Figure 1: Nanorobot[4]

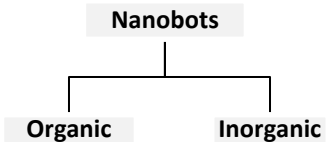
Classification of Nanobots

Nanorobots are broadly divided into various categories based on the type of material and construction method used for their properties.

Types of Nanorobots are given as follows:

Types of Nanobots

In this section first we discuss the Organic and Inorganic types of nanorobots .[13]



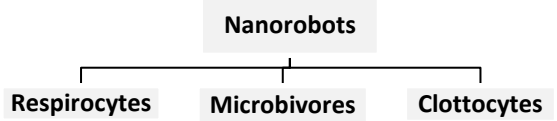
Organic Nanobots

- It is also known as bio-nanorobots.
- It is produced by viruses and bacteria DNA cell.
- These are less toxic to the organisms.

Inorganic Nanorobots

- It is made by protein synthesis and other type of material.
- This kind of nanorobots act like diamond structure.
- It is more harmful but this problem is overcome by encapsulate the robots.

Nanorobots as artificial blood were designed by Robert A. freitas jr.[14]



Respirocytes

Respirocytes is prepared by 18 billion atoms properly arranged in a diamondoid pressure tanks.

Respirocytes nanorobots which produce artificially like red blood cell with size 1.4um in diameter. It reserve 3 billion oxygen carbon dioxide molecule is advantage over the natural red blood cell. Which having capability to supply 2-6 time more oxygen to body tissue.

Microbivores

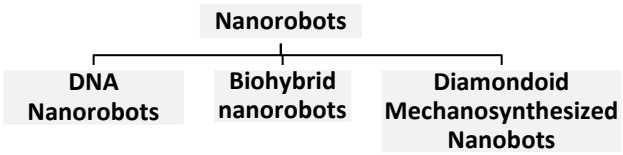
These are also called as nanorobotic phagocytosis which function as artificial white blood cells. These are prepared from diamond and sapphire.

Microbivores are spheroid device having 3.4-2.0um size in diameter with respect to major and minor axis respectively 610 billion structural atoms. The main role of microbivores is phagocytosis that absorbs pathogen and digest in blood stream.

Clottocytes

Clottocytes are 100-1000 times faster than the natural hemostatic system. These are consisting biodegradable mesh. Clottocyte rich blood enters the injured blood vessels, the on-board sensors of it detects the change in partial pressure.

Type of nanorobots based on type of material and construction method are as follows.[15]



DNA Nanorobots

Scientist come with new technique that is DNA strands layering upon them self and produces nanomaterial with flexible properties and that produced DNA origami.

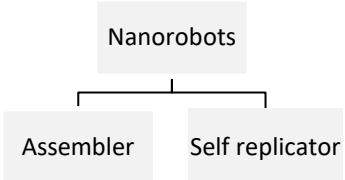
Biohybrid Nanorobots

Biohybrid nanorobots are consisting of biological molecule and electronical generate wave that enable the rapid movement of bot to various locations.

Diamondiod Mechanosynthesized Nanorobots

According to Robort A. Freitas diamondius mechanosynthesis nanorobots are such types of nanorobots where in every part of nanobots are build and positional controlled from start to finish position. Mechanosynthesis is the process building accurate structure on nano and microscale by managing the covalent bond using mechanical forces.

Types of nanorobots based on construction.[16]



Assembler

Assemblers are the simple cell shaped nanobot that are capable to clarify the different types of atom or molecule. These type of nanobot are managed by specific specialized program.

Self Replicator

Self replicator are basically assembler and able to replicate itself at a very large level and fast rate.

Some other types of nanorobots are as follows.[17]

There are various types of nanorobotic devices that have been developed so far by scientists and engineers.

- **Nano Manipulators.**
- **Bio nanorobotics (DNA- and Protein-Based Nanorobotic Systems)**
- **Magnetically Guided Nanorobotic Systems.**
- **Bacterial-Based Nanorobotics.**

Nano Manipulators

Initially Scanning Probe Microscope resembles like a three degree of-freedom (DOF) of a robotic manipulator, which has the ability to put x-y-z at its top but has no orientation capability. The manipulation power of Scanning Probe Microscope depends on the inter-atomic forces built between the Scanning Probe Microscope tip and the atoms to be manipulated. The Scanning Probe Microscope tip acts as an end-effector manipulator and is the main nano component of the nano manipulator.

Bio nanorobotics (DNA- and Protein-Based Nanorobotic Systems)

The term bio nanorobotics, first introduced in 2003, refers to all nanorobotic systems that include nanocomponents based on biological factors such as proteins and DNA. Bio nanorobotic systems are different from medical nanorobots bio nanorobotic systems include biological-based substances but not used in medical applications. Bio nanorobotics is a subgroup of molecular machines and machine components that has grown rapidly over the last decades. The main goal in the bio nanorobotic field is to use a variety of biological elements - their function at the cellular level that creates motion, force, or signal — as nanorobotic elements. These components perform their preplanned biological function in response to specific physiochemical catalyst but in an artificial state. In this way, proteins and DNA can act as motors, machine joints, transmission elements, or sensors.

Magnetically Guided Nanorobotic Systems

This nanorobot is basically a simple nanoparticle containing ferromagnetic material. The actuation and conduction of energy can be achieved using external magnetic forces and its gradients that can use six degree-of freedom magnetic forces on the nanoparticle. Sensing and tracking of nanoparticle movements can be performed

using external imaging techniques such as microscopes or magnetic resonance imaging (MRI) scanners. When the actuation and sensing have been achieved using external magnetic field and imaging methods then it is possible to apply a closed loop control algorithm as shown in will guide the nanoparticle / nanorobot to the desired location.

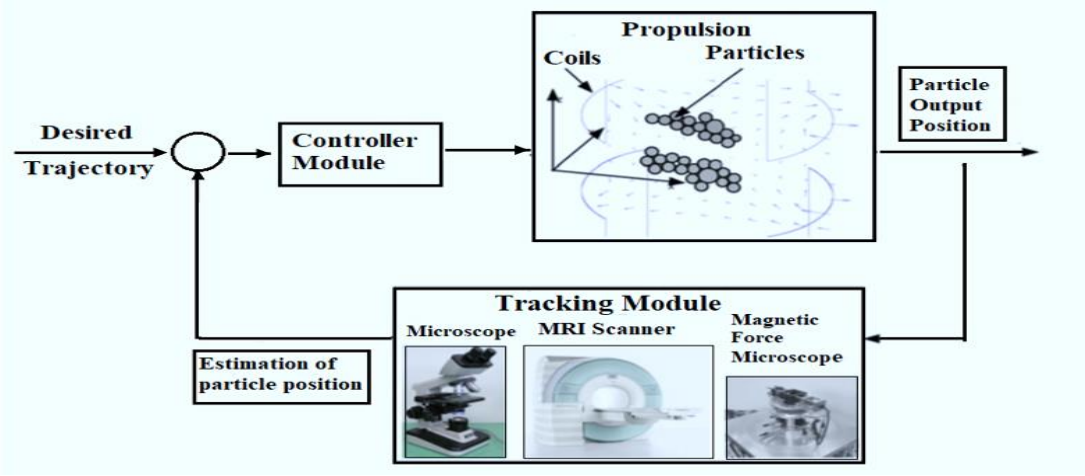


Figure 2: Diagrammatical representation of magnetically driven Nanoparticles using external magnetic fields and imaging modalities [17]

Bacterial-Based Nanorobotics

It is the type of nanorobotic system which is based on the way bacteria travel in a liquid environment. This is a "biomimetic" type of nanorobot that uses systems or concepts that occur naturally. There are two different ways to build nanorobotic systems based on bacteria. The first method uses living bacteria to act as a nanorobotic system that will travel through the liquid and manipulate objects in it. Second method is to develop artificial bacterial-like nanorobots that are powered by using external magnetic field.

Approach for Treatment

Now a days the medical system or therapy used for diagnosis and in treatment of various diseases have limitation such as, pain in surgery and delay onset of action and does not bind directly on target cell. To overcome such problems scientists have move towards nanobots. Nanobots bind directly on target site and release the drug and give immediate relief to the patient. Nanobots are also useful in the diagnosis of disease to find out any defect in the body. These are also beneficial in the damaged tissue and regrowth of tissue.

Cancer

A group of south Korean scientists belonging to Chonnam National University has discovered the organic nanorobots produce by genetic modification in salmonella bacteria such nanorobots does not show toxicity, when the cancer cell released molecules then nanorobots attracted this molecule this nanorobots is called as Bacteriobot and their size is about 3 micrometers. Nanorobots release the drug at a site of action after reach the cancer cell. The Bacteriobot were designed in such way that to act on colorectal tumors and attained adequate results in test with laboratory rat.[18]

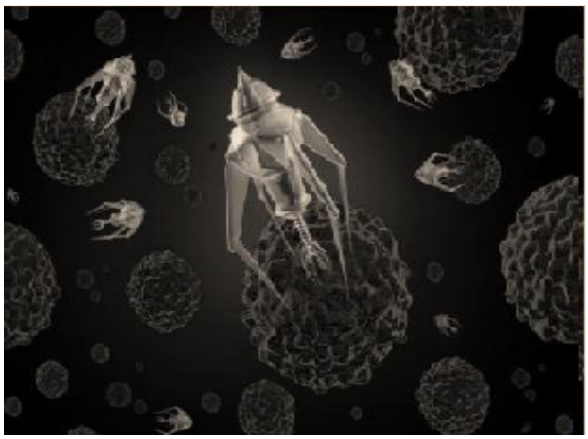


Figure 3: Nanorobot Treating Cancer cell [5]

DNA Nanorobots for Cancer Treatment

The Church lab described the prototype of DNA nanorobots in 2012 which was able to transfer the drug molecule on the specific cancer cell in tissue culture further Li et al has taken a step forward in the vivo use of DNA nanorobot for cancer treatment as show in fig 4 A. Design of nanorobot-Th with DNA origami. The robot opened itself on when it detected the nucleolin. B. The action mechanism of nanorobot-Th in plasma with HUVECs. C. The nanorobot (green) was specifically targeted to blood vessel-rich areas (brown). Mice with MDAMB231 tumors were injected intravenously with FITC-labeled nanorobots. Tumor slices were stained with an anti-CD34 antibody and evaluated using confocal microscopy eight hours later. D. The therapeutic mechanism of nanorobot-Th within tumor vessels. E. Representative images of tumors in MDAMB231 tumor-bearing mice after saline and nanorobot-Th treatments. Their robot was built using aptamer and DNA origami to wrap a 90 - nm tube that convey blood coagulation protease thrombin inside, which is protected from circulating platelets and plasma fibrinogen. The adoption

and binding of the aptamer to its target tumor molecule caused the robot to be exposed to thrombin in the bloodstream, which in turn stimulated localization of the tumor, leading to tumor necrosis and inhibiting tumor growth. Since all feeding vessels are almost identical, this strategy could be effective in combating many deadly diseases.[19]

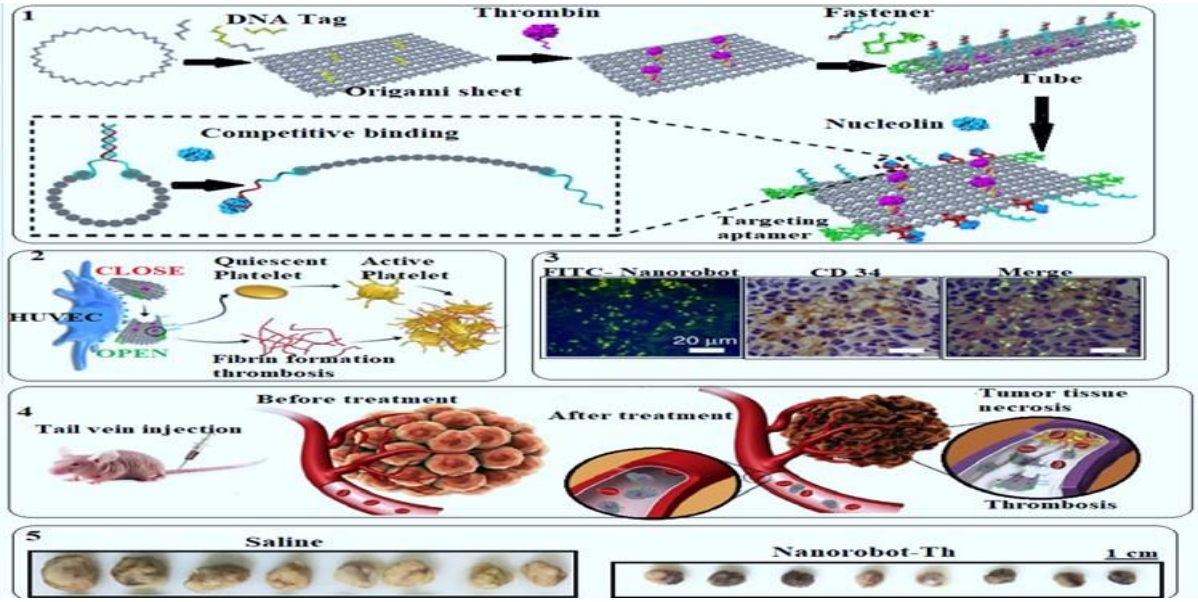


Figure 4: A DNA nanorobot for targeted treatment .[19]

Nanorobots for Breast Cancer

Nanorobots developed on basis of various types of DNA which have low cost and easy for therapeutic drug. Recent studies shows that tetrahedral framework nucleic acid has promising DNA nanocarrier for various anticancer drug because of its high biocompatibility and biosecurity. For example, paclitaxel and doxorubicin were delivered with the help of TFNA to cancer cell for overcome drug resistance, Si RNA which alter into TFNA for target specific drug delivery. TFNA which is carries antisense peptide nucleic acid to obstruct methicillin resistant staphylococcus aureus. Preparation and storage of tFNA are not complicated and can be easily converted into lysosomes by cells. As HApt and tFNA can be converted into lysosomes both in combination can be used as novel DNA nanorobot would be novel strategy for effective delivery of HER-2 positive breast cancer.[20]

Medical Nanorobots a Cure to Demyelination

When introduced nanobots into a nerves they detect the electrical signal i.e. nerve impulse Nanobots specifically find out the demyelinated area and cures it by delivering the myelin sheath over it. The surgical procedure is less invasive. Nerve borne nanobot give better understanding of connection between nerve signals and disease also give help in quickly diagnosis and give new therapeutic procedures. [21]

Nanorobots in Alzheimer's Disease

Nanorobots can be used in older adults to test the blood for β-amyloid (Aβ) and tau, biomarkers of AD, thus monitoring the onset of disease and growth. Nanorobots can also be programmed to withdraw bloodborne Aβ, which if the peripheral sink hypothesis of AD holds true can help reduce basic illness and thus improve cognition or delay cognitive decline. In addition, if bleeding across the blood-brain barrier (BBB) is one day in technology, nanorobots can enter the central nervous system (CNS) to fight infections directly. The directed movement of nanorobots can be reach by the detection of chemotactic molecules in the same way as microglial migration. The vast majority of microglia themselves can be targeted and 'programmed' to function as endogenous nanorobots. For example, microglia can be manipulated to increase their phagocytic capacity to reduce the accumulation of Aβ. Nanorobots can also be designed to deliver therapeutic agent such as anti-amyloid or anti-tau therapy and anti-inflammatory drugs directly to the CNS. [22]

Nanobots for Blood Clots

The nanobots give their activity when they reach the target site. The nanobot deposited to a suitable surface by using the probes and delivered the medicine over the clots. For dissolving the clot use any type of drug which used for thrombolysis. Recently rt-PA (Recombinant tissue plasminogen activator) like drug is use for thrombolysis. More amount of energy required for completing process like driving, operation and information transmission of the clot dissolving process.[23]

Cleaning and Breaking up Blood Clots

Blood clots leads to serious injury in body like muscle death and stroke. When nanobots go towards clot and destroy it. Clottocyte or artificial platelet it is one of the type of nanorobots. There is small mesh net contain the clottocyte which is dissolved from the sticky membrane when it comes in contact with blood plasma. This type of nanobot

are useful for dissolving and cleaning of clots but it have disadvantage when they losing the small piece of bot in the blood stream this bot move in the of body and create problem. The robot are very minute in size that they cannot stop the blood flow.[24]

Nanobots for Local Anaesthesia In Dentistry

For the purpose of local anesthesia in dentistry colloidal suspension containing millions of active analgesic micron-size dental robots will be infuse on the patient's gingival. When nanobots come in contact with crown or mucosa the moving nanobots go towards the pulp through gingival sulcus, lamina propria, and dentinal tubules with the help of chemical gradients and temperature differentials. This process control by dentist by using nano computer. After fixing the nanorobots in the pulp then these robots decreases the sensitivity of specific tooth that need treatment. Once the procedures are completed these nanorobots return all sensation.[25]

Nanorobots for Influenza

For identification of influenza nanorobots detect the different level of alpha-N- acetyl galactosaminidase i.e., alpha-NAGA with the help of chemical sensor like inserted nanoelectronics. As per clinical analysis, in the initial stage of influenza development the alpha-NAGA proteins are well known established as medical target. In this study the nanorobots used as a mobile medical device that is inserted via bloodstream and mobile medical device created the 3D environment and collected historical clinical data of blood flow patterns and morphological parameter from the patient blood with influenza virus.[26]

Nanorobots for Precision Surgery

The aim behind invention of robotic system is to lessen the problem associated in surgery and to increases the potentiality of human surgeons. This type of robot help in surgery and permit doctor to carry out hardly invasive surgery with high precision, flexibility, and control.

Recently the nanorobots have shown ability to address these limitation and for these use tiny devices for precision surgery. Micro/Nanorobotic tools which are free from tethered ranging from nano drillers to microgrippers and micro bullets provide distinctive capacity for minimally invasive surgery. Dimensions of micro/nanorobots which is appropriate with biological entities which required treatment in this condition nanorobots gives vital advantages for high precision, minimally invasive surgery. Moving micro/nanorobots charged by diverse energy sources with nanoscale surgical components are capable to directly penetrate or recover cellular tissues for precision surgery.[27]

Nanorobots for Parkinson's Disease

Our concept is based on the use of Nanorobotic drugs to treat Parkinson's disease by initiating neural regeneration in Substantia Nigra of dopamine-producing cells. Nanorobotics is a fast-growing therapeutic component with nanobots components on a small nanometer scale. Another definition is a robot that allows direct contact with nanoscale objects, or that can control with nanoscale adjustment. Our main idea is that nanotechnology can be used to provide bioactive scaffolds for dopaminergic cell regeneration, or even that nanobots can eventually form cells themselves during a single surgical procedure.

When combining nanotech medical robots with nanomaterial scaffold the theory is that nanobots can convey the scaffold to the right place, where the cells die. The way in which they do this by picking up chemical signals produced by cells. This has already been shown to be effective when medical nanotech robots have been used to identify target cancer cells. Joseph Irudayaraj has published a paper on how the use of gold nanorods and magnetic particles will detect nanobots in the body using MRI imaging. Their pathway can also be monitored and, in the case of cancer cells, they will enter the cancerous tissue by pointing to the signs of protein on their face. When we use this technology in our treatment of Parkinson's nanobots instead they target dead dopaminergic neurons by searching for dopamine produced at high concentrations in Substantia Nigra and releasing propidium iodide. By starting with a high concentration of dopamine they will be able to find themselves in the right region of the brain because not all cells will be dead so this could be a region of very high dopamine production. Once they are in the right place, which will be determined using an MRI scan, nanobots can then find dead cells by releasing propidium iodide, a fluorescent dye. Propidium iodide cannot pass through cell membrane of suitable cells but can enter dead cells and attach to double stranded nucleic acid. If the nanobot cell that clings to it acquire propidium iodide then it will know that the cell must be dead. However, if propidium iodide can pass through the cell membrane then this could cause the nanobot to move to a different cell. [28]

Nanorobots for Detoxification

Automatic micro/nanorobots have high cleansing ability which is use for detoxification purpose. Like biosensor, Detoxification technique based on self- assembled micro/nanorobots which are quickly catch and eliminate the toxin and give the environment nontoxic substance. An active movement helps the collision and binds the toxin to the motors, which are cover with functional materials. For example, nanomotors are coupled with natural products made by cells - able to imitate the natural structures of their source cells - to novel nanoscale biodetoxification devices.[29]

Robots in Nano gene Therapy

The medical nanorobot is able to treat genetic disorders by comparing the structure of DNA cells and proteins within a cell to known or desired reference structures. Any irregularities can be corrected or reversed there. It floats inside the nucleus of a human cell, a repair vessel designed to meet the function of genetic maintenance. The

molecular structure of DNA and proteins is compared with the information keep in a large nano computer database put outside the nucleus and connected to a cell repair vessel via communication link. The repair vessel would be smaller than most germs and viruses, but they able to treat and cure.[30]

An Artificial Oxygen Carrier Nanorobot

The "Respirocytes" is an artificial red cell, a hypothetical nanorobot floating in a blood stream. It is mainly a small pressure tank that can be filled full of oxygen (O_2) and carbon dioxide (CO_2). Later, these gases can be released from a small tank in a controlled manner. Such types of atoms are mostly carbon atoms arranged as diamond in a porous lattice structure inside a spherical shell.

External part of all devices there are gas concentration sensors. When a nanorobot passes through the capillaries of the lungs, the partial pressure of O_2 is high and the partial pressure of CO_2 is low, so the mounted computer tells the filter rotors to load the tanks with oxygen and release CO_2. When the partial pressure of CO_2 is comparatively high and the partial pressure of O_2 is comparatively low the computer on the board instructs the filter rotors to extract O_2 and absorb CO_2. Respirocytes promote the action of red blood cells which are filled with natural hemoglobin, but can deliver 236 times more oxygen per unit volume than a natural red cell.[31]

Gout

Gout is disease in which kidney unable to breakdown the fats present in blood stream. There are excessive accumulation of fats in blood stream leads to crystallization at the ankles and knees people distressed from these disease feel severe pain basic movement. A nanobot which destroy the crystal present at joint and give temporary relief from the disease .[15]

Kidney Stone

Doctors usually destroy the stone with help of ultrasonic frequencies >=20Khz but it is not more potent, A nanobot breakdown the kidney stone into tiny size through on-board laser and tiny parts of stone passed out of the kidney more simply decrease pain.

The nanobot it also contain device which produce ultrasonic frequencies and break up stone into tiny size. Another way to break up kidney stone by use of sintered carbide cutter.[15]

Liver Stone

These are which accumulate in bile duct over period of time due to large amount of cholesterol. Liver stones are not much harmful than kidney stone. It is simple way to administer of nanobots into bile duct and after that rupture liver stone as well as it is clear the unwanted minerals and substance from bile duct.[15]

Disease Diagnosis and Prevention

Nano biotech scientists have well developed microchips are cover with human molecules. This chip gives electrical impulse signal when the molecules detect the signs of diseases. When special sensor nanorobots injected into blood via skin it gives indication when any kind of diseases present blood. It is also useful to determine sugar level.[4]

Nanobots in Diabetes Detection

The size of free moving nanobots is less than 0.2 um. The preprogrammed biocompatibility which effect on the various immune reaction occurs in body.

The major function of in build Nano sensors are as follows

1. When it monitor or determine blood glucose levels as well as it also determine HSGLT3 protein sensory activity
2. If patient required insulin, then chemo-sensor will detect it.[32]

Nanorobot in Heart-Attack Prevention

Nanorobots are helpful to prevent heart-attacks and it is also responsible to remove yellow fat deposits insides of blood vessels. Due to this improve blood flow and flexibility of the walls of the arteries. From this assumption, the lipid lowering drug substances such as lovastatin, simvastatin will be reached at the site of action with the help of nanorobots.[33]

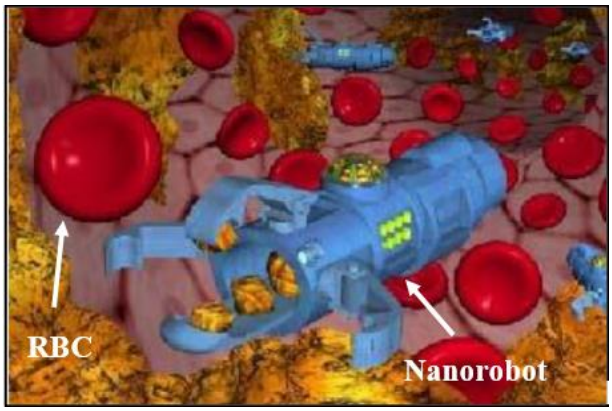


Figure 5: Nanorobot used for preventing Heart- Attack [5]

Nanorobots in Cerebral Aneurysm

Now a day's micro devices such as nanorobots are developed are useful to treat cerebral aneurysm surgery. The protein nitric oxide synthase (NOS) is an important factor which shows positive or negative effect on the cells and tissue present in the cellular living processes. Due to this mechanism when the level of NOS is elevated and brain aneurysm occurred.

Nanorobots can be made such type for the detection of different level of inducible nitric oxide synthase (iNOS) in brain aneurysm, chemical nano sensors are implant into the nanorobots. Starting stages of brain aneurysm development is detected by the iNOS proteins act as medical targets. Nanorobots developed such as when they

entering in bloodstream which act as movable devices and include clinical data of patient with cerebral aneurysm based on morphological parameter. [34]

Nanorobots for Detection of Cancer

Nanorobots will be capable to detect different harmful cell types and normal cells by looking at their higher antigens. This is achieved by the use of chemotactic nerves embedded in certain antigens in target cells. One approach towards in the innovative methodology to procure decentralized control for action in the combat of cancer. Using chemical sensors can be activated to detect different levels of E-cadherin and beta-catenin in the early and metastatic stages. Medical nanorobots will then demolish these cells.[35]

Ideal Feature of Nanobots[36]

- The size of Nanobot should be in between 0.5 – 3 microns with the large parts 1 to 100 nm.
- The capillary flow stopped by larger size nanobots from above range.
- Nanobots will be stop itself by attacking from the immune system which have passive, diamond external.
- These nanorobots will be in communicating with doctor about acoustic signal by transporter of radio emission frequencies of 1 to 100 MHz, with coding messages.
- Self- Replication process done, when nanobots probably generate its numerous copies to restore worn out units. This method referred to as Self replication process.

Advantages of Nanobots [37-40]

- Nanorobots achieved remote areas in human body which is difficult to surgeon for operate.
- Nanobots technique is non-invasive and Higher accuracy
- Nanobots technology used with enhance bioavailability.
- It is used in targeted treatment like solely malignant cell treated.
- Not much post treatment care is necessary because it is inconsiderably invasive technique, so less post treatment care is needed.
- Nanorobots are small in size and higher limit of the dimensions of nanobots is 3 micron in order that it will simply flow within the body while not obstruction the capillary flow.
- The nanobots technology is cost effective technique by producing batch processing, it reduces cost than initial cost of development is more.
- Drug molecules are not active in areas wherever therapy not required and decreased in unwanted adverse effects.
- Drug particles are transported by nanorobots and released when required, the advantages of the large interstitial zone can be achieved during mass transfer.
- Computer controlled process with nobs to set amount, frequency and release time
- For the manufacturing of nanobots large amount of resources is available
- Disease is speedy eliminate by treating with nanorobots
- Nanobots are Long durability
- Using of nanobots quicker and a lots of precious diagnosis.
- Nanorobots are automated and easy to dispose.
- They continue to be operational for years, decades or centuries
- The possibilities of any after effects or recurrences are utterly eliminated.
- Damage tissue of patient should be repaired in a very few hours instead of weeks or months, and if programmed correctly, the entire damaged organ can be healed in some days.
- After the damage tissue is absolutely healed, nanorobots should separate out through programming.
- For the operate single units need minimal amount of energy.

Disadvantages of Nanobots [41-42]

- The preliminary design of nanobots price is extremely high.
- The design of the nanobots is more complex one.
- Nanobots are tough to Interface, Customize and Design, Complicate.
- If nanorobots self-replicate, a dangerous version of the nanorobots may be created.
- These nanorobots if used by terrorists may also be make use of as bio weapons and should become a harm to the society.
- Nanorobots will have negative effects if functioning of it should not be correct.
- Privacy is the alternative ability danger involved with nanorobots. As nanorobots deals with the designing of compact and minute gadgets, there are probabilities for greater.
- Electrical nanorobots are at risk of electric interference from outside sources like radio frequency

or electric powered fields, and stray fields from other in vivo electrical gadgets.

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