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An Investigated Approach for Nanorobotics in Medical Field

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ABSTRACT

Nowadays medical science is more and more improving with the blessings of new scientific discoveries. Nanotechnology is such a field which is changing vision of medical science. New automated procedures are being discovered with new aspects of self-guided nanorobots. Nanorobot is an excellent tool for future medicine.Nano robotics is the field under continous development. It involves the construction of robots of the size of 10^ - 9m.

Keywords : CMOS, HIV, CNT.

I. INTRODUCTION

Nanorobots could carry and deliver drugs into defected cells. These nanorobots will be able to repair tissues, clean blood vessels and airways, transform our physiological capabilities, and even potentially counter act the aging process. Many scientists working on this bright field of nanorobots especially on Alzheimer disease and cancer treatments. The engineering of molecular products needs to be carried out by robotic devices, which have been termed Nano robots. Nano robotics, sometimes referred to as molecular robotics, is an emerging research area as evidenced by recent topics in the literature. A multifunctional platform based on nanorobots, with various types of nanomachines will surely fight against major diseases like cancer, HIV etc. In this review, we will summarize briefly about nanorobots and its tools, mechanism, approaches and main futuristic applications of the same which mainly useful for medicinal and to develop new formulations related to nanotechnology to cure the major diseases.

II. METHODS AND MATERIAL

History of Nanorobotics

The history of the nanorobotics as an integrated circuit for medicine is highlighted as an advanced CMOS nanoelectronics device. The practical experimental nanorobot invention comprises an engineered based prototyping device with applied approach using manufacturing methodologies with current and emerging technology trends.

Nanorobots can provide enormous impact for the development and implementation of advanced biomedical instrumentation with remarkable improvement to common clinical practice. It offers a cutting edge technology for diagnosis, drug delivery, laparoscopic nanosurgery, and health care, with therapeutic applications for cancer, diabetes, brain aneurysm, contagious desiases, and cardiology.

Structure of a nanorobotics

In order to explore the possibilities of molecular manufacturing, it is necessary that first the nanocomponents be created, analyzed and tested. Many researchers say that silicon can be used as the primary material. However, constructing these components using silicon would mean that these components would be non-biodegradable.

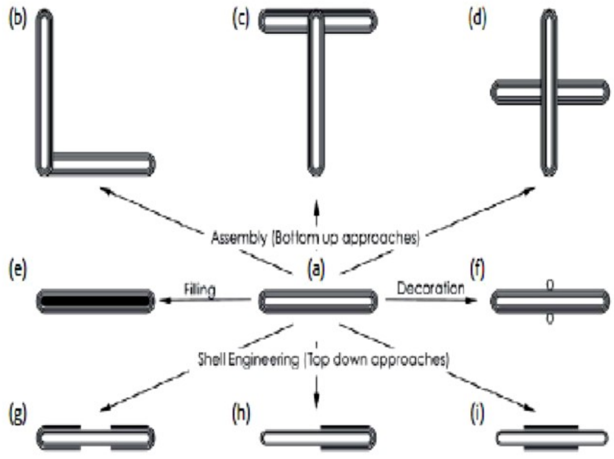

Figure 1.

CNT-based building blocks. Starting from (a) as-grown CNTs, nanostructures can be created by the bottom-up approaches of (b–d) assembling, (e) filling, or (f) decorating them, or in a top-down fashion by (g–i) engineering their shells/caps.

Approaches for nanorobotics

The development of nanorobots is done by using various approaches such as

1. Biochip

The combination of nanotechnology, photo-lithography and new biomaterials, can be considered as a possible way required for designing technology to develop nanorobots for medical applications such as diagnosis and drug delivery. This realistic approach in designing nanorobots is a methodology which is used in the electronic industries.

2. Nubots

Nubot is an acronym for "nucleic acid robots." Nubots are manmade robotics devices at the Nanoscale. Representative nubots includes numerous Deoxy Nucleic Acid walkers reported by Ned Seeman's group at NYU, Niles Pierce's group at Caltech, John Reif's group at Duke University, Chengde Mao's group at Purdue, and Andrew Turberfield's group at the University of Oxford.

3. Positional Nanoassembly

In the year 2000, Robert Frietas and Ralph Merkle found nanofactory collaboration which is an ongoing effort consisting of ten organizations with 23 researchers from four countries. This collaboration aims at developing positionally controlled mechanosynthesis and diamondoid nanofactory which is capable of constructing a diamondoid medical nanorobot.

4. Usage of Bacteria

This approach makes use of biological microorganisms, such as Escherichia coil bacteria. So this model uses a flagellum for propulsion purpose. The use of electromagnetic fields is to control the motion of biological integrated device and its limited applications.

Nanorobotics Applications

1. Nanorobotics in Surgery

Surgical nanorobots are introduced into the human body through vascular systems and other cavities. Surgical nanorobots act as semi-autonomous on-site surgeon inside the human body and are programmed or directed by a human surgeon. This programmed surgical nanorobot performs various functions like searching for pathogens, and then diagnosis and correction of lesions by nano-manipulation synchronized by an on-board computer while conserving and contacting with the supervisory surgeon through coded ultrasound signals.

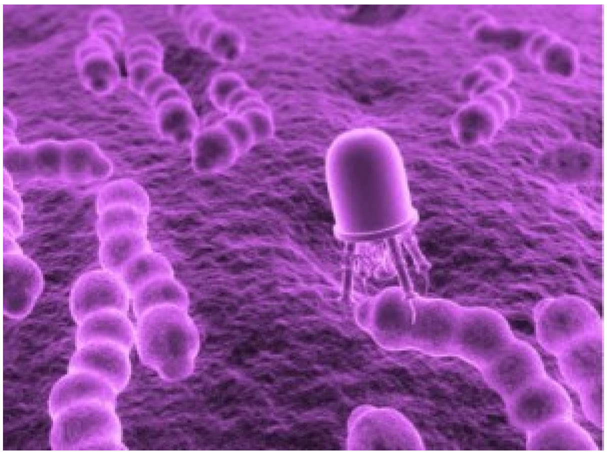

Figure 2. Nanorobotics in Surgery

2. Diagnosis and Testing

Medical nanorobots are used for the purpose of diagnosis, testing and monitoring of microorganisms, tissues and cells in the blood stream. These nanorobots are capable of noting down the record, and report some vital signs such as temperature, pressure and immune system's parameters of different parts of the human body continuously.

3. Nanorobotics in Gene Therapy

Nanorobots are also applicable in treating genetic diseases, by relating the molecular structures of DNA and proteins in the cell. The modifications and irregularities in the DNA and protein sequences are then corrected (edited). The chromosomal replacement therapy is very efficient compared to the cell repair. An assembled repair vessel is inbuilt in the human body to perform the maintenance of genetics by floating inside the nucleus of a cell.

Figure 3. Nanorobotics in Gene Therapy

Supercoil of DNA when enlarged within its lower pair of robotic arms, the nanomachine pulls the strand which is unwounded for analysis; meanwhile the upper arms detach the proteins from the chain. The information which is stored in the large nanocomputer's database is placed outside the nucleus and compared with the molecular structures of both DNA and proteins that are connected through communication link to cell repair ship. Abnormalities found in the structures are corrected, and the proteins reattached to the Deoxy Nucleic Acid chain once again reforms into their original form.

III. RESULTS AND DISCUSSION

Nanorobots in Cancer Detection and Treatment

The current stages of medical technologies and therapy tools are used for the successful treatment of cancer. The important aspect to achieve a successful treatment is based on the improvement of efficient drug delivery to decrease the side-effects from the chemotherapy.

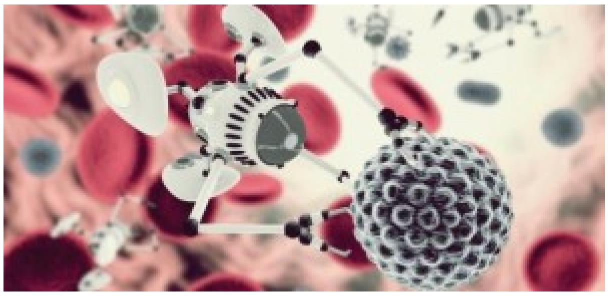

Figure 4. Nanorobots in Cancer Detection and Treatment

Other Applications of Nanorobotics

Nanorobots find a variety of applications, particularly, in medicine. Due to the specificity of a nanorobot to target a particular cell, nanorobots can be majorly used for 'targetedcell drug delivery' and also to 'identify and isolate cancer/malignant cells'. Nanorobots can also play andimportant role in Tissue Engineering. They could rebuild tissue molecules in order to close a wound, or rebuild the walls of veins and arteries to stop bleeding. They could make their way through the bloodstream to the heart and perform heart surgery molecule by molecule without many of the risks anddiscomfort associated with traditional open-heart operations.

Likewise, researchers hope that nanorobots will have many miraculous effects on brain research, cancer research, and finding cures for difficult diseases like leukemia and AIDS.

Space scientists and researchers are betting a great deal on the use of nanorobots in space explorations and various other related activities. An 'unusual' application of nanorobots is also proposed in the exploration of subterranean oil reservoirs and maximization of hydrocarbon recovery.

IV. CONCLUSION

The most challenging task to create a nanobot is to be able to create a whole set of specialized machine-tools in order to speed the process of nanobot building. Nanobots measure more like six atoms across, but the design is highly complicated and need to be engineered in such a way that they are autonomous. Typically, ideal nanobot consists of transporting mechanism, an internal processor and a fuel unit of some kind that enables it to function. The main difficulty arises in shrinking the robotic propulsion system to nanoscale with existing technology. scientists are working hard to develop these tiny systems and hopefully come up with functional autonomous nanorobots sometime in the next two decades.

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