IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 4, April 2022
Impact Factor: 6.252

Applications of Nanorobotics in Medicines

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Abstract: *Nanorobotics is the technology of producing robots or machines with very small scale or miniscule of a nanometre (10^{-9} meters), machines constructed at the molecular level (Nano machines) may be used to cure the human body of its various diseases like cancer. Nano robots perform a specific task with great accuracy and precision at nanoscale dimensions. Nano robots are especially used for studies on osteosclerosis treatment and cancer treatments. Nanotechnology promises futuristic applications such as microscopic robots that assemble other machines or travel inside the body to deliver drugs or API or do microsurgery. Current treatment includes surgeries which are considered out-dated when compared to nanotechnology or nanorobotics technology.*

Keywords: Nano robots, Biochip, Nubots, Nanoswimmers, Treatment, Disease. etc.

I. INTRODUCTION

Nanrobotics refers to nanotechnology- an engineering discipline for designing and building (developing) Nano robots. These devices range from 0.1-10 micrometers and are made up of nano scale or molecular components. As no artificial, non-biological nanorobots (machines) have yet been created, they remain a pretending concept. The names nano robots, nanoids, nanomites have also been used to describe these hypothetical devices.

Nano robots can be used in different application areas such as medicine (to cure or treat the diseases) and space technology. Nowadays, these Nano robots play a crucial role in the field of Bio-Medicine, particularly for the treatment of cancer, cerebral Aneurysm, in surgery, removal of kidney stones, elimination of defected parts in the DNA structure, and for some other treatments that support to save human lives.

Nano robots are nano devices used for the purpose of protecting the human body against pathogens. Nano robots are builded by many elements or parts like actuators, sensors, power, control, communication and by interfacing cross-special scales between organic inorganic systems. The development of nano robots by using various approaches such as

A. 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 approach in designing nanorobots this methodology which is used in the electronic industries.

B. Nubots

Nubot is an abbreviation 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.

C. Positional Nano assembly

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

D. 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 electromagnetic fields is used to control the motion of biological integrated device and its limited applications.

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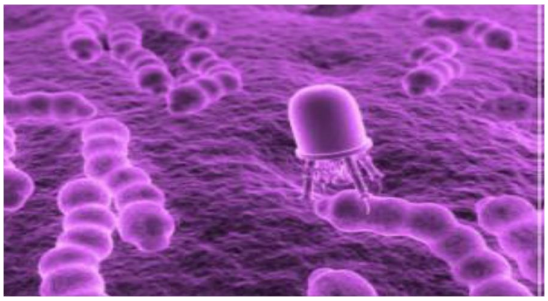
II. TYPES OF NANOROBOTS

1. **Smallest Engine Ever Created:** A cluster of physicists from the University of Mainz in Germany recently designed the littlest engine ever created from simply one atom. like all alternative engine, it converts energy into movement, however it will therefore on a smaller scale than ever seen before. The atom is cornered in a very cone of electromagnetic energy and lasers square measure accustomed heat it up and cool it down, that causes the atom to move back and forth within the cone like an engine piston.
2. **3D-Motion Nanomachines from Desoxyribonucleic Acid:** Mechanical engineers at Ohio State University have designed and made advanced nanoscale mechanical components using DNA origami'proving that an equivalent basic design principles that apply to typical full-size machine components will currently even be applied to DNA and might manufacture advanced, controllable components for future nanorobots.
3. **Nanoswimmers:** ETH Zurich an Technion researchers have developed an elastic Nano swimmer polypyrrole (Ppy) nanowire regarding fifteen micrometers (millionths of a meter) long and two hundred nanometers thick that may move through biological fluid environments at nearly fifteen micrometers per second…The nanoswimmers might be functionalized to deliver medicine and magnetically controlled to swim through the blood to focus on cancer cells, as an example.
4. **Ant-like Nanoengine with 100x Force Per Unit Weight:** University of Cambridge researchers have developed a little engine capable of a force per unit-weight nearly 100 times over any motor or muscle. The new nanoengines may lead to nanorobots small enough to enter living cells to fight illness or disease, the researchers say. Academician Jeremy Baumberg from the Cavendish Laboratory, who led the research, has named the devices _actuating nanotransducers'(ANTs). Like real ants, they manufacture massive forces for their weight.
5. **Sperm-Inspired Microrobots:** A group of scientist at the University of Twente (Netherlands) and German University in Cairo (Egypt) has created sperm-inspired microrobots, which could be controlled by periodical weak magnetic fields.‖ they go to be used in advanced micro-manipulation and targeted medical aid tasks.
6. **Bacteria-Powered Robots:** Bacteria-powered robots: Drexel University engineers have developed a way for using electrical fields to help microscopic bacteria-powered robots notice obstacles in their setting and navigate around them. Uses include delivering medication, manipulating stem cells to direct their growth, or building a microstructure, as an example.
7. **Nanorockets:** Many teams of scientists (researchers) have recently made a high-speed, pilotless nanoscale version of a rocket by combining nanoparticles with biological molecules. The researchers hope to develop the rocket therefore it will be utilized in any environment; as an example, to deliver medicine to a target area of the body.

III. APPLICATIONS OF NANOROBOTICS

3.1 In Surgery

Surgical nanorobots act as semi-autonomous on-site surgeon inside the human body and are programmed or directed by a human surgeon. This surgical nanorobots are performs the varied functions like find out the pathogens, and then kills them or 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. Nanorobotics in Surgery Nowadays, the earlier forms of cellular nano-surgery are being explored. For example, nanorobots contains the micropipette which micropipette vibrating rapidly at a frequency of 100 Hz micropipette comparatively less than 1 micron tip diameter is used to cut dendrites from single neurons. This method isn't got to harm or damage the cell capability.



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3.2 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.

3.3 Nanorobotics in Gene Therapy

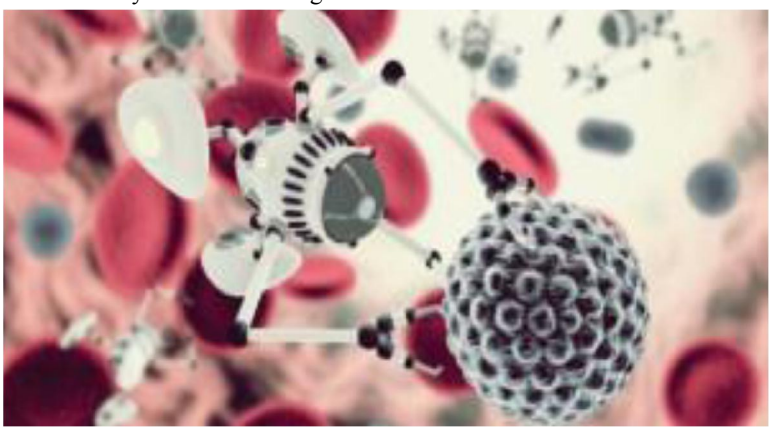
Nanorobots are applicable in curing genetic diseases, by relating the molecular structures of DNA and proteins in the cell. The modifications and irregularities in the DNA and protein sequences are then corrected (edited). The chromosomal replacement therapy is extremely economical compared to the cell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

3.4 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.

3.5 Nanorobots in Cancer Detection and Treatment

The current stages of medical technologies and medical care tools are used for the successful treatment of cancer. The vital side to attain a successful treatment is based on the improvement of economical drug delivery to decrease the side-effects from the chemotherapy. Nanorobots in Cancer Detection and Treatment Nanorobots with embedded chemical biosensors are used for detecting the tumour cells in early stages of cancer development within a patient‘s body. Nanosensors are utilised to search out the intensity of E-cadherin signals.



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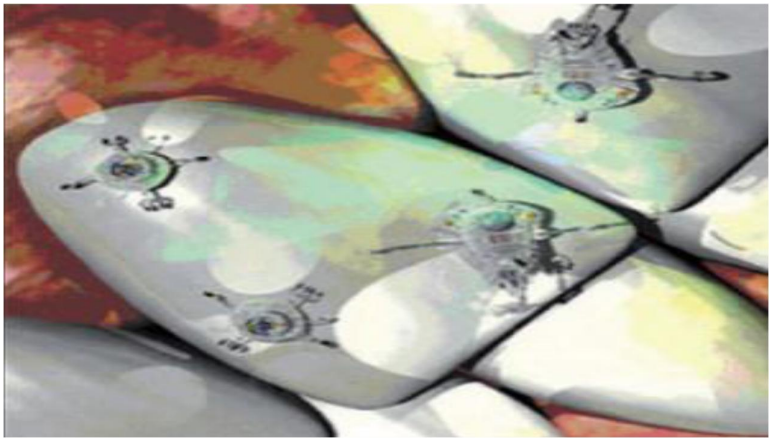
3.6 Nanodentistry

Nanodentistry is most commonly used as nanorobots, help in several processes involved in dentistry. These nanorobots are used in desensitizing tooth, oral anesthesia, straightening of irregular set of teeth and improvement of the teeth sturdiness, major tooth repairs and improvement of look of teeth, etc.



3.7 Use of Nanorobots Diabetic Patients

Nanorobots can also be used as ancillary devices for processing different chemical reactions in the affected organs. These robots are also useful for monitoring and controlling the glucose levels in diabetic patients.

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Impact Factor: 6.252

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