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Nanotechnology In Pharmacy

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ABSTRACT -

Since the introduction of nanorobotics, the discipline of medicinal chemistry has seen an exponential development in the uses of nanotechnology. One of the most potential uses of nanotechnology is in the creation of nanobots, which can be applied to a variety of industries like as medicine delivery, medical imaging, and even the development of The benefits of nanobots include their small size, light weight, great flexibility, high sensitivity, and big thrust-to-weight ratio.

Nanobots have several uses and are being investigated in many domains. This review's objective is to provide an overview of the rapidly developing subject of medicinal chemistry's nanorobotics and its potential applications in the identification, management, and prevention of a range of illnesses. It offers a thorough synopsis of the advancements made in nanobot technology.

KEYWORDS -NANOROBOTS,BIOCHIP, NUBOTS,DNA NANOBOT

Introduction-

Advanced medical technology known as nanorobotics is utilized to identify and treat illnesses. The tools used to diagnose diseases inside the body are called nanorobotics. It is the science of building devices or robots that are almost as small as a nanometer. These gadgets have sizes between 0.1 and 10 micrometers. They consist of molecular constituents. It's an idea of pretending.[1]

The Greek word "dwarf" is where the word "nano" comes from. The field of nanotechnology was initially defined by RAYNMAN in 1959. He received the Nobel Prize. In order to prepare for a lecture titled "There's plenty of room at the bottom," he received the prize. He concluded by saying, "This is a development which I think cannot be avoided," to wrap up the talk. Considering that nanorobots are tiny, it would likely be required for a very large number of them to cooperate in order to carry out both microscopic and macroscopic activities, according to nanorobotic theory. [2]

NANOROBOTS-

The creation of effective robots depends heavily on nanorobotics. It builds the robots' structure with nano components and their items. Because of its nanoscale structure, engineers and scientists are able to create human mimics. Nanorobotics can assist in the efficient construction of the majority of complicated robot components. Devices developed using nanorobotics are referred to as hypothetical devices; they go by names like nanobots, nanoids, nanites, or nano-mites. All robots with nano-scaling are operated at nano-scale resolution; nanorobotics enables robots to perform precise tasks and interact with objects at the nanoscale. Every element of a robot, ranging from the external body to the infrastructure chip, is configured at the atomic level. Despite the fact that nanorobotics complicates the robot's construction.[3]

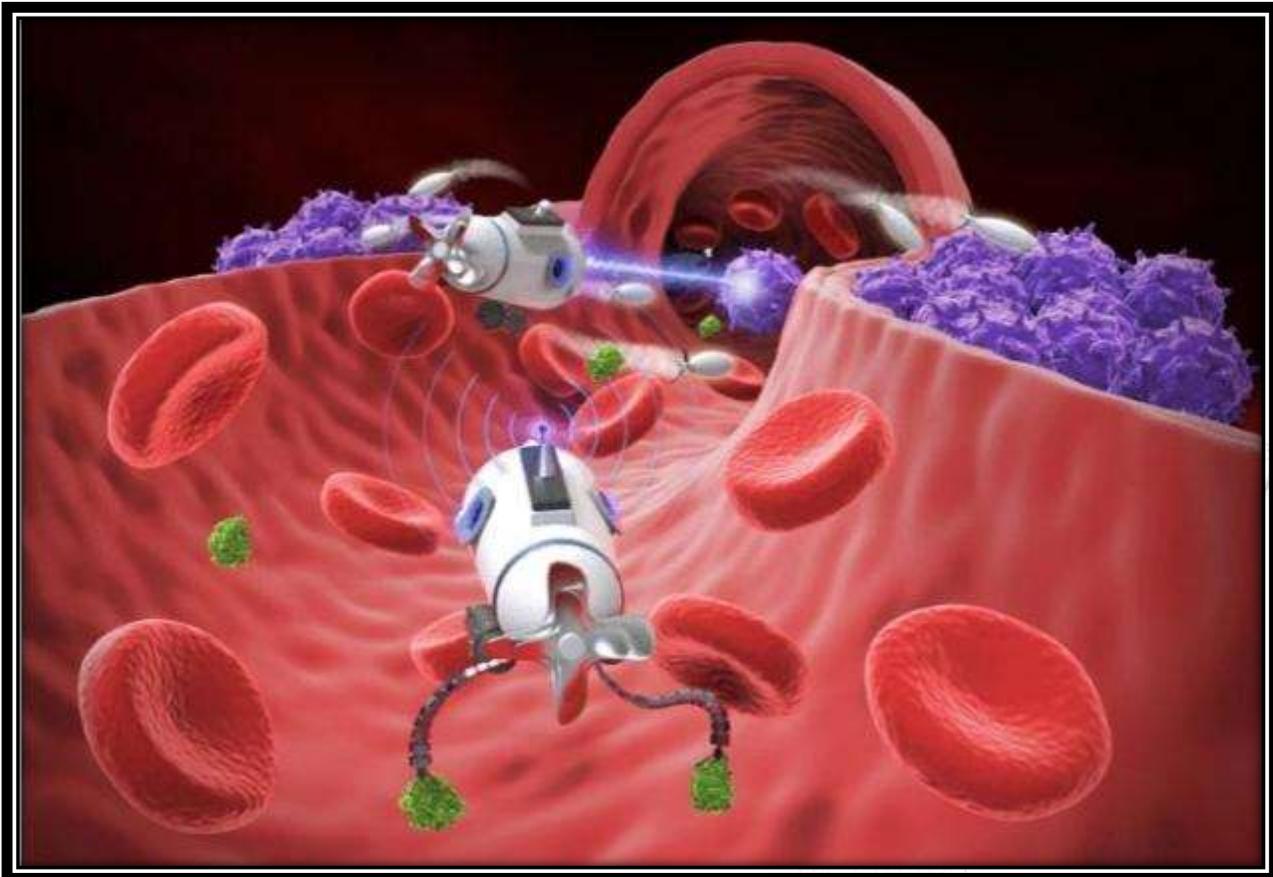
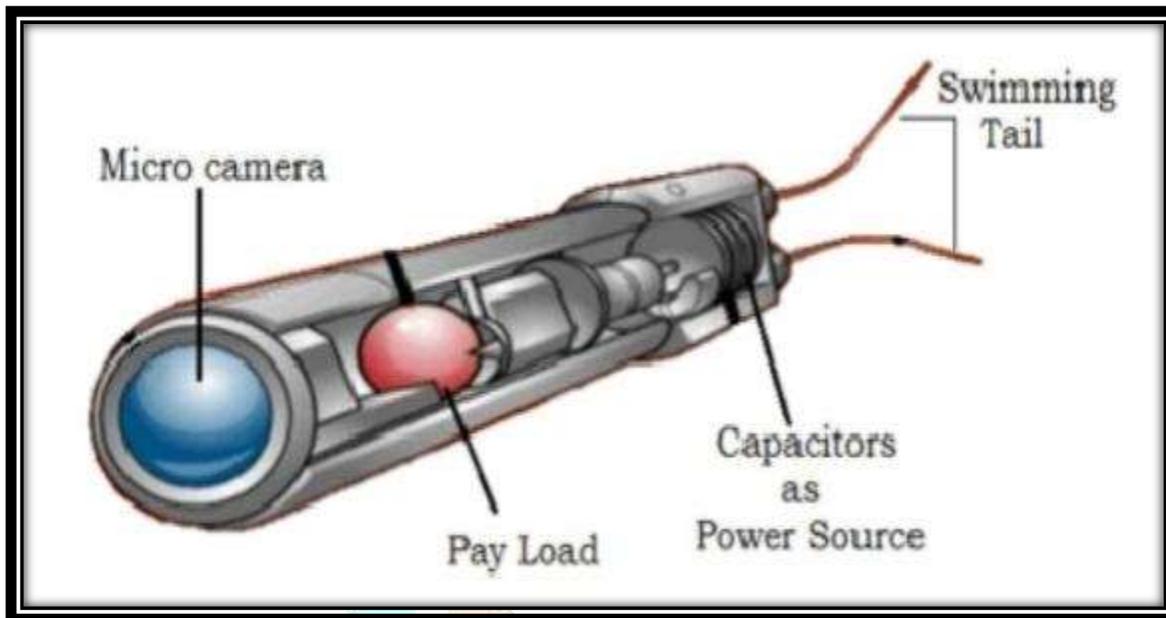


Fig1.Nanorobotsinhuman body

Biochip:-

The combined use of photolithography, nanoelectronics, and novel biomaterials may be a means of enabling the necessary manufacturing technology for nanorobots for common medical applications, including drug delivery, surgical instrumentation, and diagnosis. In fact, the electronics sector is now using this practical method of producing nanotechnology. Therefore, useful nanorobots ought to be included into nanoelectronics devices, enabling teleoperation and improved functionalities.[4]

Fig-2. Biochip and its component



Nubots-

The term "nucleic acid robots" is shortened to "nubot." The nanoscale synthetic robotics devices are called nubots. Several DNA walkers described by the groups of Ned Seaman at NYU, Niles Pierce at Caltech, John Reif at Duke University, Chengde Mao at Purdue, and Andrew Turberfield at the University of Oxford are examples of representative nubots.[5]

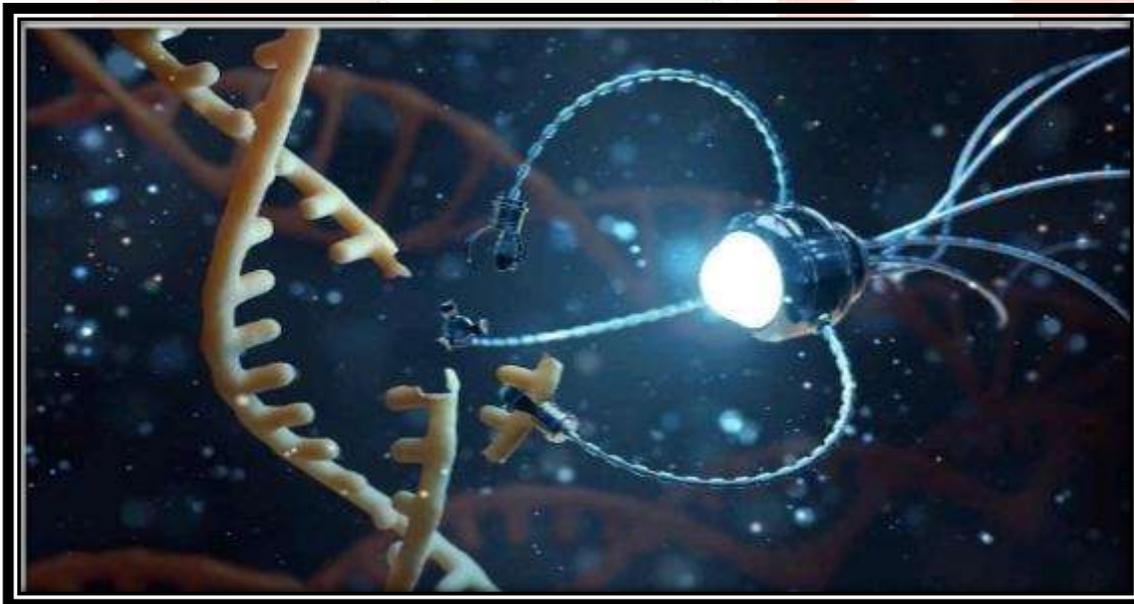


Fig-3.Nubots

2D and 3D nanomechanical devices can be constructed using DNA structure. Proteins, tiny molecules, and other DNA molecules can be used to trigger DNA-based devices. DNA-based biological circuit gates have been created as molecular devices that enable in-vitro drug delivery for certain medical conditions.[6]

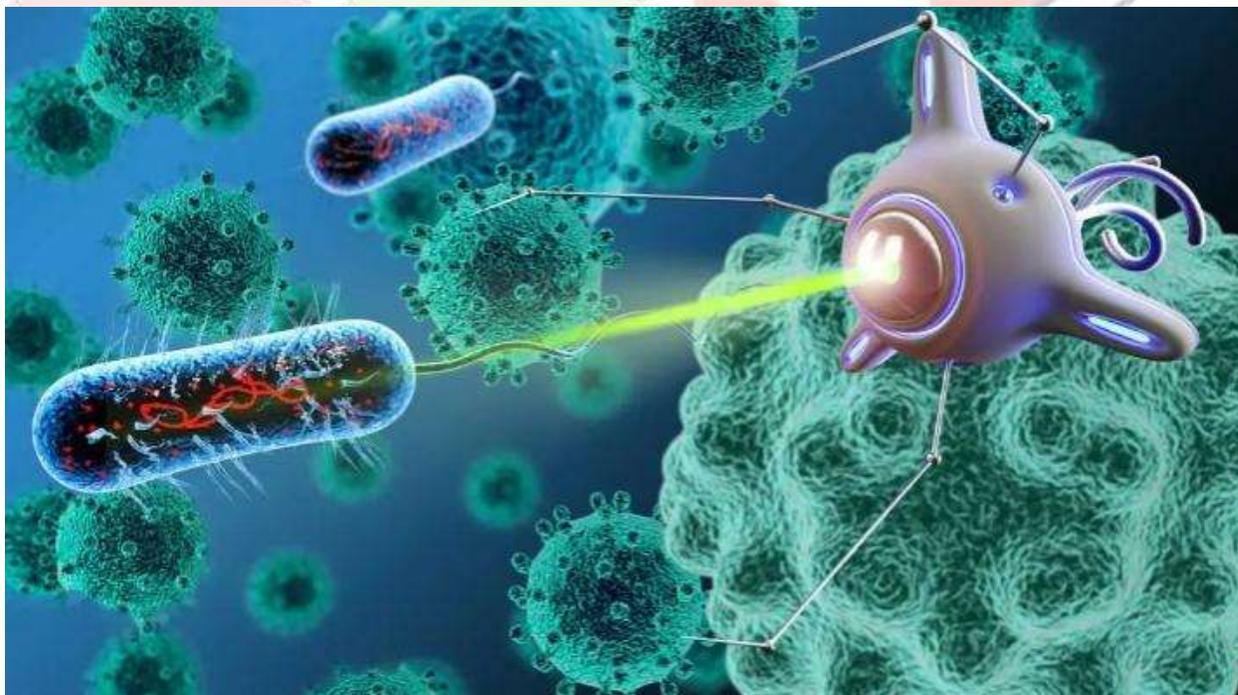
DNA NANOBOTS-

To prevent adverse effects, DNA nanobots are utilized to deliver the medication to the desired cell. Their goal is to create dynamic DNA nanostructures that can perform certain functions through state transitions, ranging from hybridizing and denaturing individual bases to hybridizing and denaturing entire strands. DNA origami, in which a single long strand of DNA is folded with the assistance of smaller staple strands to create the required structure, is used by DNA nanobots. The foundation of this technique is the folding of the big ssDNA, which is normally the M13 bacteriophage's 7.3 kilobase genome, with an excess of smaller complementary strands known as staple strands, which are usually 32 bases. At least two different sections of the lengthy ssDNA are complementary to these strands. [7][8]

APPLICATION -

1. In cancer treatment:

Fig-4. Nanorobots in treatment in cancer New developments in drug delivery have led to better focused drug delivery that can identify specific cells and control discharges using smart medications. Conventional chemotherapy medications work by destroying rapidly proliferating cells, which are a hallmark of cancerous cells. The majority of anticancer drugs have a narrow therapeutic window and frequently cause cytotoxicity to rapidly proliferating normal stem cells, including bone marrow, macrophages, the gastrointestinal tract (GIT), and hair follicles. This can lead to a number of negative side effects, including organ dysfunction, thrombocytopenia/anemia, alopecia (hair loss), mucositis (inflammation of the lining of the GIT), myelosuppression (lower synthesis of WBCs, producing immunosuppression) thrombocytopenia/anemia, and haematological side effects, among others. Hodgkin's disease is among the many types of cancer that are treated with doxorubicin. [9][10]



2. For Surgery:

In order to address issues related to intricate surgical operations and to increase the proficiency of human surgeons, robots were developed. In the quickly developing field of robot-assisted surgery, physicians can carry out a range of minimally invasive treatments with exceptional control, flexibility, and precision. Because nanobots can journey to hard-to-reach areas in the human body, they can target a wide range of specific health

disorders. Recent nanobots have showed great potential for precision surgery and for resolving the Fig-4 Nanorobotics in cancer therapy

shortcomings of present surgical techniques . Untethered nanorobotic instruments, such as micro-grippers, microbullets, and nanodrillers, have special capabilities for minimally invasive surgery. Due to their size compatibility with the tiny biological entities that they operate on, nanobots provide significant benefits for high precision minimally invasive surgery[11][12]

3.C. GENE THERAPY-

Using Nanorobotics Because nanorobots can relate the molecular structures of DNA and proteins in cells, they can also be used to treat genetic illnesses. After that, the changes and anomalies in the protein and DNA sequences are fixed (edited). When compared to cell repair, chromosomal replacement therapy is much more effective. The human body has an integrated repair vessel that floats inside a cell's nucleus to carry out genetic maintenance. When the nanomachine's lower pair of robotic arms enlarges the DNA supercoil, it pulls the unwounded strand for examination, while the upper arms separate the proteins from the chain. The data kept in the database of the massive nanocomputer is positioned outside the nucleus and contrasted with the protein and DNA molecular structures that are linked via a communication channel to the cell repair ship. The proteins that have been reattached to the Deoxy Nucleic Acid chain return to their former shape after structural abnormalities have been fixed.[13]

ADVANTAGES -

It also reduces the number of surgical errors. Greater drug action speed and computer-controlled drug delivery are sublimity.

It has the ability to activate body systems and track neuro-electric impulses.

At the cellular level, nanorobots may repair and replace missing tissue.

Nanobots are precise, accurate, and have fewer side effects, allowing for the very regulated release of medication.

Numerous elderly patients will be cured and given new life by nanorobots.

HIV, cancer, and other dangerous illnesses are within the normal process of progress.

Speed, longevity, and drug delivery are provided. Illness monitoring, detection, and prevention are aided.

Illness will be treated and detected, and lost tissue will be restored at the cellular level. [14]

LIMITATION-

A. Development's High Cost One major area of worry is the high expense of research and development for uses of nanotechnology. For the less fortunate members of society, these modern medical technologies are not financially viable. They are typically both costly and inaccessible. In actuality, middle-class individuals cannot afford the use of nanotechnology in medicine and its applications.

B. Abuse There is still a need to exercise extra caution while using nanomedicine because it can be misused. Due to their tiny size, these medications have the potential to get lodged in anyone's body, which could lead to abuse of their intended function.

C. Neurodegenerative and Other Conditions Nanoparticles have been shown to produce ROS and oxidative stress, which can result in degenerative illnesses including Parkinson's and Alzheimer's. One significant disadvantage of nanomedicine is that, despite its enormous potential to increase drug delivery efficiency, nanoparticles have the potential to harm human lungs. They may also result in lung inflammation, systemic consequences, and immunological responses. Once more, nanoparticles may be absorbed by the olfactory epithelium, which could lead to damage to the epithelial cells and interfere with the nose's normal operation.

D. Negative Environmental Impacts It is well recognized that both individuals and the environment might suffer negative consequences from nanomedicine and nanoparticles. It must therefore be properly processed before being disposed of. It is well recognized that non-biodegradable nanoparticles pollute the air, water, and land. Furthermore, it is challenging to predict their negative environmental consequences, and it is unknown if they negatively affect the biome. It is evident that getting rid of them would be extremely difficult if they were to penetrate the bionetwork through plants[.15]

CONCLUSION -

With little adverse effects, the recent development of nanobots in the field of nanotechnology offers hope for the diagnosis and treatment of numerous serious illnesses, HIV, cancer, heart disease, and genetic disorders. Additionally, it is particularly helpful in the fields of dentistry and surgery. Researchers anticipate that during the next ten years, human blood will likely be teeming with microscopic nanobots that will prevent illness. By safeguarding the biological system at the molecular level, these will guarantee a healthy and long life. To assure the efficacy and safety of nanobots in the human body, as well as to enhance their architecture and functions, more research students are required.

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14. G J Vaishnav^{1*}, Aasiya Nahas², Umesh Kumar Sharma³ M.Pharm, Department of Pharmaceutics, Mar Dioscorus College of Pharmacy, Alathara, Sreekaryam, Thiruvananthapuram, Kerala, India. www.ijppr.humanjournals.com

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