NANOBOTS

Dr.Chitra Rengarajan[1], R. Deepshikaa[1], P. JayaMugundha[1], R. Raveena[2]

[1]Center for Agricultural Nanotechnology, TNAU, Coimbatore – 03
[2]Department of Environmental Sciences, TNAU, Coimbatore – 03
Corresponding Email: sulochitra@gmail.com

Introduction

Nanobots, also referred to as nanorobots, are poised to revolutionize the realm of nanotechnology, particularly in the domains of medical diagnostics and targeted drug delivery. These diminutive machines can be succinctly defined as controllable, nanoscale devices comprising a sensor and a motor, capable of executing precise tasks with unprecedented accuracy.Nanorobotics, a field also known as nanoids, encompasses the design, development, and deployment of devices at the atomic, molecular, and cellular levels. The pioneering work of Robert Freitas, which focused on the development of medicinal nanobots, notably artificial red blood cells, laid the groundwork for this rapidly evolving field (Rao *et al*., 2014).

Fig: 1 :Nanobots (or) Nanorobots

NANOBOT PROPERTIES:

Nanobots can be fabricated utilizing a diverse array of materials, including organic compounds such as proteins and polynucleotides, as well as inorganic substances like metals and diamond. The surface characteristics of these nanoscale machines play a crucial role in determining their solubility, interactions with macromolecules, and cell surface binding affinity. Moreover, the size and shape of a nanobot significantly influence its mobility, permeability, and overall stability (Mazumder*et al*., 2020).Nanobots are engineered to detect specific biomarkers, navigate to targeted areas within the body, and transmit feedback signals. The integration of nanomotors and Nano-Electro-Mechanical Systems (NEMS) enables the precise propulsion and movement of these tiny machines, facilitating their intended functions.

NANOBOTS AS NANOMEDICINE:

Nanorobotics holds immense promise for revolutionizing various aspects of medicine, particularly in the realms of early diagnosis, targeted drug delivery, biomedical instrumentation, surgery, pharmacokinetics, and monitoring chronic conditions such as diabetes. By leveraging nanorobots, medications can be delivered directly to the site of disease, minimizing side effects and enhancing therapeutic efficacy, while also enabling real-time monitoring and facilitating minimally invasive procedures (Giri*et al*.,2021). Moreover, nanorobots can assist surgeons during operations, providing enhanced visualization, precision, and control, and can be designed to continuously monitor glucose levels, detect anomalies, and provide personalized feedback to patients. Ultimately, nanorobotics has the potential to facilitate personalized medicine by analyzing individual genetic profiles, detecting specific biomarkers, and tailoring treatment strategies accordingly, leading to improved quality of life and enhanced patient outcomes

RESPIROCYTES:

Respirocytes are artificial mechanical red blood cells designed to mimic the oxygen-carrying capacity of natural red blood cells. These spherical, blood-borne nanobots measure 1 micrometer in diameter and are composed of a robust diamondoid container capable of withstanding pressures of up to 1000 atm. Remarkably, Respirocytes can deliver an astonishing 235 times more oxygen to body tissues compared to their natural counterparts.

CLOTTOCYTES:

Clottocytes, on the other hand, are artificial platelets powered by serum-oxyglucose. These nanobots are engineered to rapidly accelerate the clotting process, significantly reducing bleeding time and blood loss. In stark contrast to the natural clotting time of 4-5 minutes, Clottocytes can achieve clotting in a mere 1 second.

Despite the promising potential of these nanobots, several risks and limitations need to be addressed. The absorption of biomolecules or materials by nanobots can lead to oxidative stress, causing DNA damage and other adverse effects. Furthermore, the inability to control the movement of nanoparticles throughout the body poses a significant risk, as they may accumulate in undesirable locations and trigger unintended side effects.

CONCLUSION:

Nanobots have transitioned from conceptual frameworks to tangible entities, with ongoing development efforts focused on refining their core components. These components encompass advanced sensors, sophisticated propulsion systems, and precise navigation mechanisms. Notably, research in this domain is heavily concentrated on the development of nanomotors, a crucial element of the propulsion system. Various types of nanomotors, including chemically driven, magnetically controlled, and acoustically powered variants, have been successfully fabricated and applied primarily in the realm of nanomedicine. The rapid convergence of advancements in nanotechnology, biotechnology, and computer science is poised to accelerate the creation of fully functional nanobots, paving the way for groundbreaking innovations in various fields.

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