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EDITORIAL

Nanotechnology: Challenges and Applications in Nano Medicine

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Editorial

In recent years, nanotechnology—a synthesis of various scientific and technological fields—has advanced significantly and is seen to be crucial to the transformation of the health care industry. It has the potential to revolutionize a number of illnesses and conditions, tailored medication delivery, drug research, and discovery. Most of the applications are in clinical studies at present. Several nanosystems, including carbon nanotubes, dendrimers, nanowires, nanoshells, and nano crystals, are used in cancer treatment [1]. The development of nanotechnology aids in the management of neurodegenerative conditions like Alzheimer's and Parkinson's, Treatment of tuberculosis, clinical use of nanotechnology in ophthalmology, operational dentistry, surgery, tissue engineering, visualization, immunological response, and antibiotic resistance. Nanotechnology's capacity to manipulate matter at the smallest scale is transforming sectors including biology, cognitive science, and information technology and creating new connections between these and other domains. Nanotechnology has the potential to improve every facet of human life with more research. Leading industries that will be impacted by advancements in nanotechnology include medicine, regenerative medicine, stem cell research, and nutraceuticals [2].

A new platform for medical development has been made possible by nanotechnology. Items in the nano range used for illness prevention, diagnosis, and therapy are referred to as nanomedicine. The ability to function as nanomedicine is made possible by the special qualities of nanoparticles, such as their increased surface area, quantum effect, self-assembly, etc. The seemingly unharmful connection between nanotechnology and medicine is the foundation for each of these distinct characteristics. Even today, a number of serious and complex illnesses that are causing a significant problem for humanity include diabetes, cancer, Parkinson's disease, Alzheimer's disease, cardiovascular disease, multiple sclerosis, and various serious inflammatory or infectious diseases (like HIV). One use of nanotechnology in the medical and health fields is called nanomedicine. Nanomaterials and nanoelectronic biosensors are used in nanomedicine. Molecular nanotechnology will help nanomedicine in the future. There are numerous anticipated advantages to the medical application of

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nanotechnology, which could be beneficial to all human species. It is possible to replicate or mend damaged tissue with the use of nanotechnology. These so-called artificially stimulated cells are employed in tissue engineering, which has the potential to transform artificial implants or organ transplantation. Carbon nanotubes can be used to create sophisticated biosensors with unique properties. These biosensors can shed light on the origins of life and be applied to astrobiology. Additionally, sensors for the diagnosis of cancer are being developed using this technology. Despite being inert, a probe molecule can functionalize the tip of a carbon nanotube [3].

The capacity of nanotechnology to distinguish between cancerous and non-cancerous cells is one of its main benefits. Once NP has been directed to the location, it can trigger cytotoxic reactions by reactive oxygen-mediated death, drug release, or hyperthermia. The majority of medications are administered orally during chemotherapy. As a result, the drug's effects extend throughout the body, resulting in several adverse effects such bodily aches, weakness, and hair loss. If the medication is only present at the tumor location, this can be prevented. Nanoparticles can be efficiently used as vectors to deliver cancer therapy drugs to the site of malignancy. Nanotechnology will be essential in the next fifty years because it will safeguard the environment and supply enough energy for a world that is expanding. Advanced nanotechnology techniques can aid in energy storage, energy conversion into other forms, environmentally friendly material manufacture, and improved renewable energy sources. Fuel cells, hydrogen, solar, and nano-catalysis are all applications of nanotechnology that can produce energy more cheaply and sustainably. Carbon nanotube fuel cells are utilized in power cars because they can store hydrogen [2].

Additionally, nanotechnology is assisting in the fields of synthetic artificial organs and regenerative medicine. Numerous nano-based structures have been created thus far. For instance, the trachea, which was created using a nanocomposite polymer seeded with the patient's stem cells, was successfully transplanted. One of the biggest fields to gain from the combination of tissue engineering and nanotechnology is orthopedic implants. Alumina, titanium, and hydroxyapatite were employed. Since there is no globally recognized standard procedure for toxicity testing of nanomaterials, nanotoxicology is also a major source for worry. It is exceedingly challenging to establish nanotoxicity results because researchers use their own protocol. In addition to toxicity, certain other issues receive less attention, such as the local supply chain for products based on nanotechnology or the potential for local manufacture or invention. Despite its many advantages, its commercial application has been restricted by monodispersity, uncontrolled size, and a laborious production process [1].

The development of nanoscience and nanotechnology has raised our expectations for improved medical treatment. Nanotechnology applications have become widely used in the medical field. Clarifying how nanotechnology affects biological systems is crucial before it can make an impact on the health sector. The primary need is to investigate how the physiochemical characteristics of nanomaterials interact with the surfaces and spaces provided by various organelles, living cells, tissues, and organisms overall. Even with all of nanotechnology's advantages, there are still a lot of unsolved issues and safety worries. Because of its immense potential, nanotechnology in medicine has a very bright future and the potential to entirely take over the health sector if these obstacles can be overcome [3].

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