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Nanoparticles and Its Applications

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INTRODUCTION

Nanotechnology is a technology that deals with items that are only a few nanometers in size. Nanotechnology is projected to develop on various levels, including materials, devices, and systems. Nano materials are currently the most advanced, both in terms of scientific understanding and commercial uses. Nanoparticles were investigated a decade ago because of their size-dependent physical and chemical features. They've now moved on to commercial exploration. Cells in living animals are typically 10 meters in diameter. The cell pieces, on the other hand, are significantly smaller, measuring in the sub-micron range. Proteins are even smaller, with a mean size of just 5 nm, comparable to the dimensions of the tiniest artificial nanoparticles. This simple size comparison suggests that nanoparticles could be used as extremely small probes to see cellular machinery without causing too much interference. Nanotechnology progress is fueled by a deep understanding of biological processes at the Nano scale level. Optical and magnetic effects are the most commonly exploited for biological applications among the many size-dependent physical properties available to someone interested in the practical side of nanomaterial. The goal of this study is to provide readers with a historical perspective on nanomaterial applications in biology and medicine, as well as an overview of recent discoveries in the field and a discussion of the difficult route to commercialization. Hybrid bionanomaterials can be used to create new electrical, optoelectronic, and memory devices. This, however, will not be explored in this article and will be the subject of a later post.

APPLICATIONS OF NANOSCIENCE

Tissue engineering

The surface of natural bone frequently has 100-nanometer-wide structures. The body would try to reject an artificial bone implant if the surface was left smooth. It was shown that adding Nano-sized structures on the surface of a hip or knee prosthesis could lower the likelihood of rejection while also stimulating the creation of osteoblasts. The osteoblasts are the cells responsible for the growth of the bone matrix and are found on the advancing surface of the developing bone.

Cancer therapy

Photodynamic cancer therapy is based on the cytotoxic death of cancer cells using laser-generated atomic oxygen. When compared to healthy tissue, cancer cells take in a greater amount of a particular dye that is used to produce atomic oxygen. The hydrophobic form of the dye molecule was encased inside a porous nanoparticle to avoid this negative effect. The dye remained confined inside the Ormosil nanoparticle and did not spread to other body parts. At the same time, its ability to generate oxygen was unaffected, and the pore size of roughly 1 nm allowed oxygen to readily diffuse out.

Manipulation of cells and biomolecules

Many applications for functionalized magnetic nanoparticles have been discovered, including cell separation and probing. The majority of magnetic particles investigated so far are spherical, which limits the options for making multifunctional nanoparticles. Metal electro deposition into a nonporous alumina template can be used to make different cylindrically shaped nanoparticles.

Protein detection

Proteins are an essential component of the cell's language, machinery, and structure, and knowing their functions is critical for further advancement in human health. In immunohistochemistry, gold nanoparticles are commonly employed to detect protein-protein interactions. However, this technique's multi-simultaneous detection capabilities are quite limited.