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NANOTECHNOLOGY; Applications and Implications in the Field of Pharmacy

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ABSTRACT: Nanotechnology is the design and fabrication of materials at the atomic and molecular levels. According to the National Nanotechnology Initiative, nanotechnology refers to structures with at least one dimension in the 1-100 nm size range. Despite this limitation, nanotechnology is often used to describe structures that are several hundred nanometers in size and are created by top-down or bottom-up engineering of individual components. In this paper, we focus on the use of nanotechnology in drug delivery and identify numerous areas of opportunity where present and upcoming nanotechnologies might enable totally new classes of therapies [1].

KEYWORDS: Nanotechnology, Applications and Implications in Pharmacy, Nanotherapeutic, Atomic and Molecular.

I. INTRODUCTION

In this age of nanoscience, nanotechnology advancements have revolutionized the health-care system by developing nanostructures that greatly improve the diagnosis and therapeutic aspects of many chronic diseases such as cancer, diabetes, infectious diseases, neurodegenerative diseases, blood disorders, and orthopaedic issues. Multifunctional nanotherapeutic technologies offer enormous potential to fill gaps in the present therapeutic realm.

The Nano particulates drug delivery system offers plenty of advantages over conventional dosage forms, for example reduced toxicity, enhanced bio-distribution, and improved patient compliance. The use of nanotechnology in formulation development and lifecycle management can make drug development significantly cost effective. In addition, nanotechnology can target specific drugs, which can reduce toxicity and improve efficacy, nanotechnology-based delivery systems can also protect drugs from degradation [2].

Nanotechnology, or nanomaterials science, has great promise in many engineering materials and is a rapidly emerging and evolving scientific field. Morrison et al. (2008) describe it as the study of controlling, manipulating, and creating systems based on their atomic or molecular requirements. The power of this method, according to the US National Science and Technology Council, is miniaturized manipulation of matter at the atomic, molecular, and supramolecular levels (sized between 1 and 100nm) to construct novel structures and technologies (Rocco et al., 2000).[3].

II. NANOMATERIALS FOR PHARMACEUTICALS

Nanomaterials are biomaterials that are utilised for surface modifications or coatings to improve the biocompatibility and bioavailability of other materials. The following materials are significant in pharmaceutical nanotechnology:

Nano crystalline materials: These are created to function as alternatives for materials with weak properties such as bioavailability, solubility, and so on.

Materials with nanostructures: These are processed forms with unique shapes and functions, such as nano- and micro-electromechanical systems, microfluidics, and microarrays. [4].

III. PHARMACEUTICAL NANOTECHNOLOGY APPLICATIONS

a) **Drug delivery systems:** Conventional drug delivery systems have limitations such as lack of specificity, higher rate of drug metabolism, cytotoxicity, high dose requirement, poor patient compliance, and so on, which can be overcome by drug delivery systems developed using pharmaceutical nanotechnology principles.

b) **Diagnosis:** Molecular imaging is the science of identifying and measuring biological processes in animals such as gene expression, protein-protein interactions, signal transduction, cellular metabolism, and intracellular and intercellular trafficking.

c) **Drug discovery:** Pharmaceutical nanotechnology plays an essential role in drug research and development by increasing the properties of powerful medicines and excipients such as solubility and bioavailability.

IV. CONCLUSION

Pharmaceutical nanotechnology has expanded its scope of research, providing new prospects in several areas of diagnosis and therapy. Pharmaceutical nanotechnology has emerged as a new field of research, with enormous promise as a carrier for a wide range of strong medications and diagnostics. It is well-established as a specialised field for medication delivery, diagnostics, prognosis, and illness therapy using nanoengineered instruments. It allows for the advancement of materials and medical devices, as well as the development of new technologies to overcome the constraints of traditional procedures.

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