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Nanotechnology in Medicine and Engineering

Mini Review

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Article Information

Received: 19 Jul 2024;
Accepted: 24 Jul 2024;
Published: 01 Aug 2024.

Abstract

Because nanotechnology enables unprecedented control at the nanoscale, it has transformed both engineering and medicine. Nanoparticles in medicine promise individualized care and improved outcomes by providing targeted drug delivery, imaging agents, and diagnostic instruments. At the same time, nanotechnology in engineering improves the qualities of materials, enabling stronger, lighter and more resilient structures that find use in everything from renewable energy to electronics. This summary examines the various ways in which nanotechnology has affected different domains, highlighting significant developments, difficulties and possible future applications.

Keywords: Materials science; Biomedical applications; Nanomaterials; Nanotechnology; Medicine; Engineering; Nanoparticles; Drug delivery; Imaging and diagnosis

Introduction

The manipulation of matter at the atomic and molecular scale, or nanotechnology, has become a disruptive force in engineering and medicine [1]. The materials have special qualities at the nanoscale that greatly differentiate them from their bulk counterparts, creating new opportunities for applications and innovation [2]. This potential has generated significant advances in a variety of fields, from the improvement of medical diagnosis and treatment protocols to the complete transformation of the composition and functionality of technical materials and equipment [3]. By providing precise instrumentation for targeted drug delivery, imaging and diagnosis, nanotechnology in medicine can maximize therapeutic efficacy and minimize side effects [4]. For example, drugs can be delivered directly to diseased cells by engineering nanoparticles so that they accumulate selectively in certain tissues. They also function as contrast agents in imaging methods, allowing for earlier and more accurate diagnosis of the disease [5]. With the ability to personalize treatments based on each patient's unique characteristics, these skills hold great promise for personalized medicine. At the same time, nanotechnology has made it possible for engineers to create lighter, stronger, and more resilient materials. Researchers can improve the mechanical, electrical and thermal characteristics of a material by working with it at the nanoscale. This opens up new possibilities for the development of electronics, aviation, renewable energy and other fields [6]. This promise is best demonstrated by nanomaterials, such as graphene and carbon nanotubes, which have greater conductivity, strength, and flexibility than conventional materials. This introduction sets the context for examining the significant influence of nanotechnology in engineering and medicine. Researchers and practitioners continue to push the boundaries of what is feasible using the

special qualities of nanoscale materials, stimulating innovation and influencing the direction of these vital domains [7].

Materials Science

Because it allows materials to be manipulated and engineered with precision at the atomic and molecular level, nanotechnology has sparked a revolution. Thanks to this capability, nanomaterials have been created with improved strength, conductivity and flexibility, which are essential for a wide range of technical applications. For example, graphene carbon nanotubes have exceptional electrical conductivity and strength-to-weight ratio, making them perfect materials for use in electronic devices and aircraft constructions [8].

Medicine

Drug delivery systems could be revolutionized by nanoparticles, which have the potential to deliver targeted drugs with fewer adverse effects. To increase treatment effectiveness, these nanoparticles can be designed to directly transport drugs to particular cells or tissues while coating them. Furthermore, contrast agents that improve the sensitivity and specificity of medical imaging procedures are made possible by nanotechnology, which is crucial for imaging and diagnosis. Early diagnosis of diseases such as cancer is made possible by this capability, which accelerates timely action and improves outcomes for patients [9].

Engineering

Advances in a variety of sectors, including electronics and renewable energy, have resulted from the incorporation of nanotechnology. Nanomaterials make high-performance parts possible, such as batteries with greater energy storage capacity and lightweight, strong composites for aircraft structures. The ability to precisely manipulate material properties at the nanoscale also enables the development of sensors with greater selectivity and sensitivity, which are essential for a variety of applications, including biological diagnostics and environmental monitoring [10].

Conclusion

In conclusion, nanotechnology has transformed the fields of engineering and medicine by facilitating the creation of stronger and lighter materials, tailored drug delivery, and better imaging. Although scalability and security issues still exist, it holds great promise for substantial improvements in sustainable technology and personalized treatment. Through continued research and interdisciplinary cooperation, nanotechnology continues to push boundaries and provide revolutionary answers to global problems.

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Citation: Onwuka KE, Akram M, Iftikhar M, Rehman TU, Garcia-Sierra F, Al-Malki RS, Ozdemir FA, Sołowski G, Fitria N, Altable M, and Sfera A; Nanotechnology in Medicine and Engineering. Medp Case Rep Clin Image. 2024; 2(4): mpcrci–202407004.