Chapter 7
Application of Nanotechnology on Medicine and Biomedical Engineering

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ABSTRACT

Numerous interdisciplinary fields, including nanomedicine, diagnostics, and nanotheranostics, have seen the extensive use of nanotechnology in biomedical engineering. This chapter will give a quick overview of nanotechnology's role as a tool that facilitates the creation of novel functional materials and medical devices here. Quantum dots, or semiconductor nanocrystals, are widely utilized in optical

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imaging for the diagnosis of conditions like cancer. Nanomaterials have potential applications as treatments and as preventative antiviral/antibacterial agents. In a similar vein, some nanomaterials have demonstrated the ability to circumvent the limitations of traditional antiviral medications. However, it's becoming more important to evaluate the negative impacts and toxicities of nanoparticles in medicine and treatments. The importance of nanoparticles in combating coronavirus disease is highlighted in this article's conversation of the most recent advancement in nanomaterials.

INTRODUCTION

The design of novel materials and gadgets is made possible by nanotechnology, ushering in a new era of biomedical engineering. A fast-moving area that unites biology, technology, and medicine is biomedical engineering. In 1954, the concept of targeted medication delivery mediated by nanoparticles was developed by Paul Ehrlich, a physician with a keen interest in immunology and bacteriology (Ai Y., et.al, 2019). The delivery method he developed was named “Zauberkugeln,” which means “magic bullets” in English. The controlled release of medications has garnered a lot of interest since this idea gained traction in the 1950s and 1960s. Figure 1 shows how nanoparticles (NPs) have evolved historically for use in biomedical applications. In 1973, Professor Peter Paul Speiser and his team conducted research on polyacrylic beads for oral administration and created nanoparticles (NPs) for vaccination and medication delivery. It takes several injections for some immunizations, such the diphtheria and tetanus shots, to accumulate enough antibodies to provide protection (Du X.-J., et.al. 2018). Albumin NPs were quickly developed at the Johns Hopkins Medical Institutions, and Kramer produced magnetic NPs using a similar process in later years. NPs were developed between 1979 and 1986 for one of the most significant uses, which is the identification of tumor cells and cancer therapy. NPs were later shown to be capable of delivering genes, DNA fragments, and anti-infective medications.

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