

Advances in Biological Science Research

A Practical Approach

Edited by
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Role of nanoparticles in advanced biomedical research

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21.1 Introduction

Nanotechnology refers to the branch of science and engineering dedicated to materials with dimensions in the range 1–100 nm. Nanoparticles (NPs) are of great scientific interest as they are effectively a bridge between bulk materials and atomic or molecular structures. Morphological and topographical features of NPs play important roles in their potential applications in various fields like biomedical, optical, storage system, magnetic separation, targeted drug delivery, electronics, etc. Consequently, with a wide range of applications available, NPs have the potential to make a significant impact on society. The characteristic feature of NPs is that the physical and chemical properties are significantly different from bulk counterparts [1]. In the case of magnetic nanomaterials, the quantum size effects and large surface area dramatically changes their magnetic behavior and they exhibit superparamagnetic phenomena with quantum tunneling of magnetization because at nano-dimensions below a critical size each particle behaves as a single magnetic domain [2]. The research associated with nanomaterials in the biological field is mostly directed toward their use in medical diagnosis and treatment of cancer-related ailments. The potential for drug delivery systems involving NPs offers several advantages such as (1) the ability to target specific locations in the body; (2) reduction of the drug quantity needed to attain a particular concentration in the vicinity of the target cells; and (3) reduction of the concentration of the drug in the normal cells to minimize the severity of size effects [3]. This chapter gives an overview of NPs in advanced biomedical research. The biomedical roles of metallic, nonmetallic (metal oxide NPs), and carbon-based nanomaterials with special reference to cancer diagnosis and treatment have been discussed.