Chapter 2
Applications in Nanomedicine and Beyond

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ABSTRACT

Materials that are biological, nonbiological, biomimetic, or hybrid are employed in a variety of nanomedicine research applications, such as high-throughput screening platforms, wearable devices, antibacterial, antiviral, and diagnostic instruments. The systematic, biomimetic, and rational process of creating the optimal therapeutic combinations has included NPs-based drug delivery. Numerous noteworthy developments in cellular, preclinical, and clinical nanomedicine research have been made, encompassing both fundamental and applied aspects. It is anticipated that in the years to come this excessive emphasis will be rectified, with research efforts shifting to other medical problems including antibiotic resistance and artificial organs. Because of the diversity of the design of the nanomaterial platform, nano-

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medicine is well-positioned to be advantageous in many domains, whether through multimodal beneficial approach or exceedingly specialized multifunctional design for pertinent natural application.

INTRODUCTION

The engineering, science and exercise of diagnosing, treating, curing, tracking, anticipating, and avoiding illnesses is known as medicine. But there is a wider spectrum of research and development in this sector. In order to work in all the ways listed below, materials and technologies with nanoscale length scales must be developed and applied. This is how nanomedicine differs from previous forms of medicine:

The interdisciplinary field of nanomedicine involves the interaction of nanoscience and nanotechnology with the biological sciences (Altınoğlu et al., 2008). We anticipate that nanomedicine will eventually touch on every facet of medicine due to its vast scope. Furthermore, nanomedicine has the same potential to enter clinics as traditional medicine as long as all prerequisites related to translation-such as safety, ethics, and regulations-are met. The goal of nanomedicine is to improve patient quality of life by facilitating the creation of more precise, effective, and personalized tools, medications, and other application for early diagnosis and behaviour of a variety of diseases. This Nano Focus aims to give a summary of current development in the field of nanomedicine, rather than to define it. Materials and technologies included are the focus of this article (Baker & Baker, 2010).

One of the main ingredients of nanomedicine are nanoparticles (NPs), of which there are many different kinds at the moment. Numerous nanomaterials can mimic a few of the roles played by spherical biological macromolecules. Numerous researchers have observed that even minor modifications to NPs' size and form can have a big impact on their characteristics. Since one must be aware of and comprehend what is being injected into the body, thorough description of NP samples used in medicinal applications is also essential. Following synthesis, a sample of NPs may exhibit heterogeneity with discrete subpopulations. The usual method is microscopic imaging, but this approach might not be enough since it can only image a minute number of NPs, which might or might not be representative of the entire sample (Baughman et al., 2002). Therefore, information regarding surface functionalization, composition, and other factors that determine properties may not be sufficiently provided by microscopic imaging (Yu et al., 2005). Additional methods that are beginning to be included in the characterization plan of nanoparticles before they are used on humans. But before being used in people, NPs should not meet any set standards for characterisation, and here is where nanomedicine applications need to concentrate.