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ENGINEERING OF NANOBIOMATERIALS

APPLICATIONS OF NANOBIOMATERIALS

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Engineered nanoparticles as a precise delivery system in cancer therapeutics

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13.1 INTRODUCTION

Today, cancer is one of the leading causes of death worldwide, with more than 10 million people being diagnosed annually and it is estimated that by 2020, there will be 15 million new cases every year (Brannon and Blanchette, 2004; Siegel and Naishadham, 2013). One of the major reason for this high mortality rate is that conventional chemotherapeutic bioactive(s) are distributed non-specifically in the body where they affect both cancer as well as normal cells the inability to deliver bioactive(s) specifically to the tumor cells without inducing severe undesirable toxic effects on healthy cells and tissues. In the past 25 years, remarkable efforts have been made in the diagnosis, therapy, and prevention of cancer, yet complete treatment of cancer has not been accomplished. The therapeutic effectiveness of a formulation is directly correlated to its ability to selectively target cancer cells, overcome biological barriers, “respond smartly,” and provide controlled and sustained release of chemotherapeutics. Thus, there is a need to develop novel drug delivery strategies and nanomedicine-based cancer therapies that provide specific targeting to tumor cells and elicit minimum toxicity to healthy cells. In recent years, significant progress has been made through the application of nanotechnology-based approaches that specifically target tumor cells and increase localized delivery by increasing serum residence time (Caldorera and Peppas, 2009; Berg et al., 2013). Although these approaches have improved the therapeutic efficacy with minimum systemic toxicity of bioactive(s), much attention on effective delivery strategies is still needed to reduce chemotherapy-related side effects and increase compliance in cancer patients.