CLEARANCE OF NANOPARTICLES DURING CIRCULATION

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9.1 INTRODUCTION

Administration of conventional therapeutic agents for cancer therapy is often limited due to their chemical properties, such as low solubility and poor stability in blood. These properties cause a short circulation half-life and low therapeutic efficacy, thus necessitating frequent administrations. In addition, toxic side effects of these agents due to nonspecific biodistribution have been additional issues in cancer chemotherapy. To overcome the limitations of conventional therapeutic agents, researchers have explored drug delivery systems that can safely and efficiently carry drugs and deliver them to the tumor site without affecting normal tissues [1–3]. In this regard, nanoparticle systems have gained a lot of interest because of the drug loading capacity and the ability to easily pass through anatomical barriers. Delivery of nanoparticles to solid tumors is facilitated by the leakiness of tumor blood vessels [4,5], and the discovery of various tumor-specific ligands has enabled more efficient delivery of nanoparticles to cancer cells [6,7].

One of the key factors to determine the targeting efficacy of nanoparticles is their blood-circulation time because long-circulating nanoparticles have more chances to transport into tumor tissues [8,9]. The circulation half-life of the nanoparticles primarily depends on the rate of the biological clearance [10,11]. The clearance mechanisms can be classified into three categories: (i) disintegration of nanoparticles by protein adsorption, (ii) opsonization-mediated nanoparticle removal by immune

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