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Chapter 5: Nanomaterial as diagnostic tool and Drug carrier

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Abstract:
Nanotechnology has revolutionized the field of medicine by providing innovative solutions for disease diagnosis and targeted drug delivery. Nanomaterials, with their unique physical and chemical properties, such as high surface area, tunable optical characteristics, and the ability to interact with biological molecules, have proven to be highly efficient diagnostic tools. These materials enhance the sensitivity and specificity of early disease detection, thereby enabling timely medical interventions. Furthermore, nanocarriers, including liposomes, polymeric nanoparticles, and metallic nanoparticles, have demonstrated great potential in delivering therapeutic agents directly to affected sites, minimizing side effects, and improving treatment outcomes. Recent advancements in nanomedicine have also led to the development of multifunctional platforms combining diagnosis and therapy, referred to as theranostics, along with applications in regenerative medicine and gene editing. Despite these promising developments, challenges such as toxicity, dosage control, and regulatory hurdles must be addressed to ensure safe and effective clinical applications. This review provides an overview of the role of nanomaterials in diagnostics and drug delivery, along with the current advancements, challenges, and future perspectives in the field.
Keywords: Nanomaterials, Drug Delivery Systems, Diagnostics, Theranostics, Targeted Therapy, Magnetic Nanoparticles, Biosensors, Regenerative Medicine, Personalized Medicine, MRI Contrast Agents, Nanocarriers, Early Disease Detection.

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