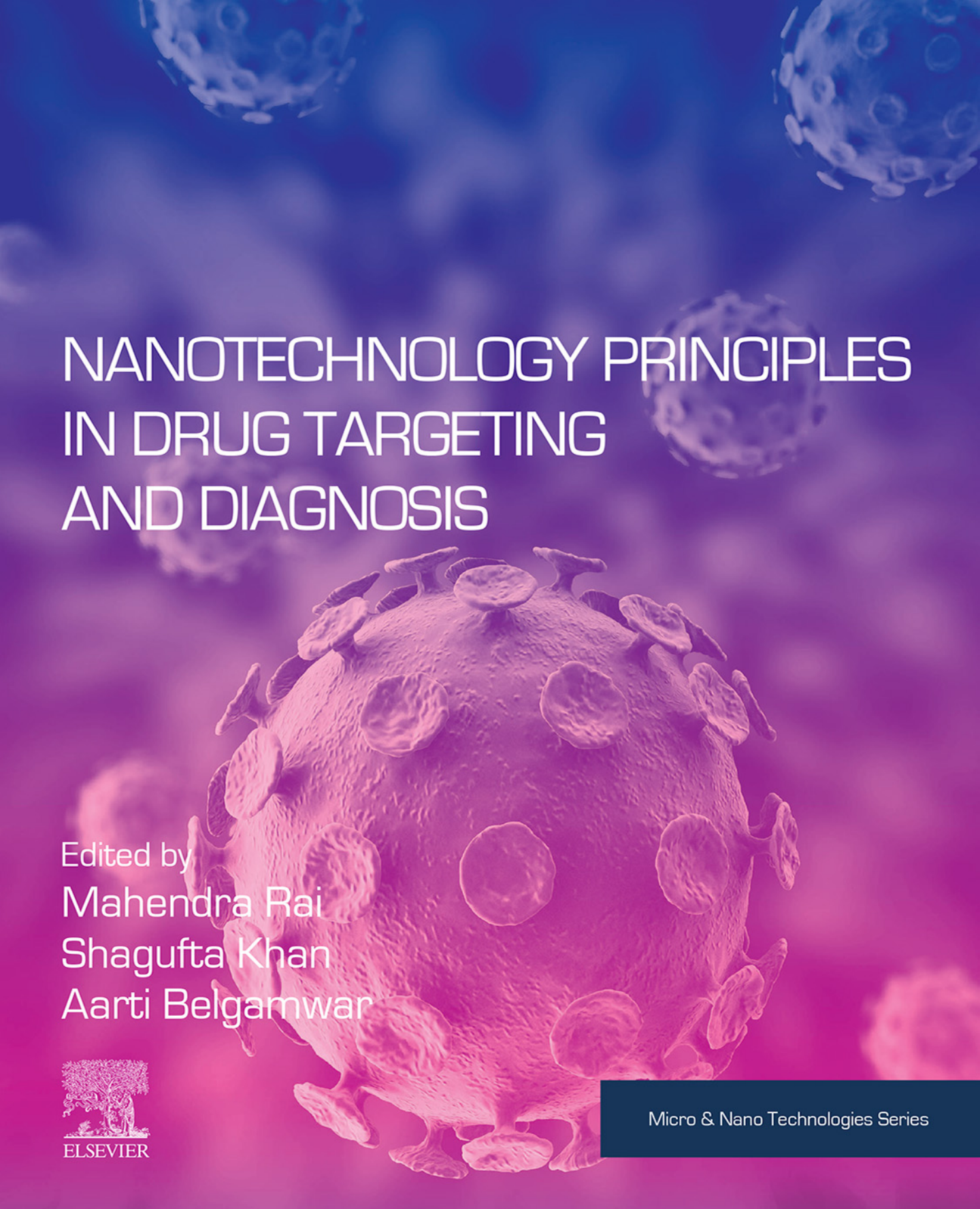
NANOTECHNOLOGY PRINCIPLES IN DRUG TARGETING AND DIAGNOSIS



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CHAPTER 2

Identifying nanocarrier–target interaction

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2.1 Introduction

The two most important approaches for targeting are passive targeting and active targeting of carriers. While active targeting involves the surface functionalization of nanocarriers with ligands tailored to the receptors expressed by the target cells, passive targeting mostly depends on particle size. The most commonly used ligands are monoclonal antibodies, peptides, nucleic acids, and aptamers. Active targeting is very promising, as it provides selective targeting with high efficiency and low toxicity. The success of active targeting depends on the affinity of the ligand for the target cells. As the receptors expressed by the target cells are also expressed by normal cells, nanocarriers many times miss the target. Entry of nanoparticles (NPs) into cells is crucial for the therapeutic efficiency of NPs. Therefore understanding the principles underlying cellular uptake is important in designing nanocarriers (Khan et al., 2022). NPs enter cells mainly by receptor-mediated endocytosis. The process of internalization depends on size, shape, and surface functionalization. Therefore cellular uptake can be optimized by controlling these parameters. Functionalization of NPs can be done by attaching peptides, antibodies, aptamers, oligosaccharides, and so forth (Sanità et al., 2020). The most common technique to monitor NP–cell interaction is fluorescence microscopy. However, fluorescence microscopy requires labeling, which may affect the drug's function. Therefore many label-free techniques have been developed over the past few years that are more sensitive than fluorescence microscopy in detecting the cellular internalization of NPs. The label-free techniques most widely used are Raman microscopy and electron microscopy. The performance of a targeted drug delivery system ex vivo does not represent its performance in vivo. Therefore probing its distribution in vivo and cellular trafficking is very important. Raman spectroscopy and its variants can track the movement of NPs across the cells successfully. This chapter focuses on the functionalization of NPs for interaction with the receptors

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