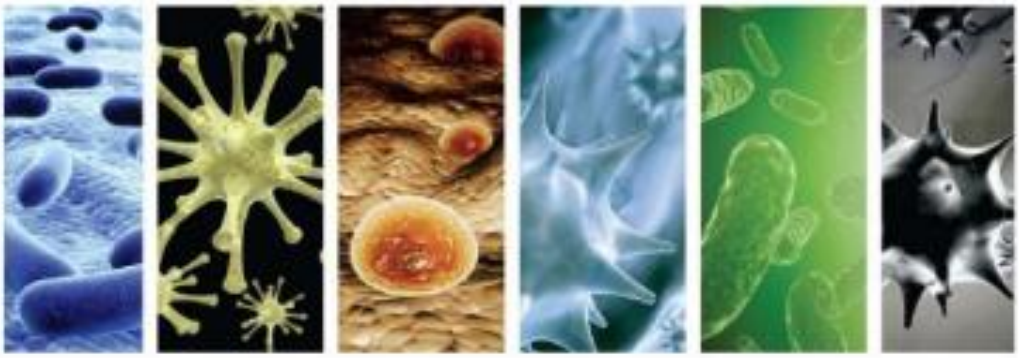
Biotechnological Advances for **Microbiology, Molecular Biology,** and **Nanotechnology**

An Interdisciplinary Approach to the Life Sciences



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CHAPTER 16 Current Perspective of Biofunctionalized Nanomaterials in Biology and Medicine

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ABSTRACT

Nanomaterials have asserted their position in almost every field due to their wide applicability. While many nanomaterials find direct application in the physical and chemical industry, their applications in pharmacology and medicine require proper modifications to make them biocompatible through a process called biofunctionalization. Biofunctionalization is a fundamental technique for permanent or temporary modification of materials by changing the properties or modification of the surface to have a biologically compatible function. Synthesis and subsequent biofunctionalization of a nanomaterial for a specific biomedical application basically depend on physicochemical and biological properties of nanomaterial. Biofunctionalization can be done using the top-down or bottom-up approach. The top-down approaches such as grinding, ball millings, and heating are the most popular physical processing methods for large scale industrial production of biofunctionalized nanomaterials that are further engineered for biomedical uses. In the bottom-up approach, physical processes like laser ablation, physical vapor deposition, and chemical processes like chemical vapor deposition, self-assembled monolayer formation are involved to make them biocompatible. Functionalization of nanomaterials surfaces implicates liposomes, polymer drug conjugates, dendrimer, polymeric nanoparticle, nucleic acid-based nanoparticles, andquantumdots fortargeted drug delivery. To engineer surfaces of these nanoparticles, various biocompatible targeting ligands categorized as organic nanocarriers such as liposomes, dendrimer, polymeric nanoparticle, peptides, aptamers, and inorganic nanoparticles like metal nanoparticles are primarily used. Surface functionalization of nanomaterials is based on the basic principle of noncovalent and covalent interactions. The noncovalent approaches include the adsorption phenomenon in which the targeting ligand is adsorbed on the surface of the nanoparticle through

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