Nanotechnology in the Life Sciences

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Functional Bionano-materials

From Biomolecules to Nanoparticles

Springer

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Chapter 8
Nanotechnology in Oral Drug Delivery: Salient Aspects, State of Art, and Applications

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Abstract Nanotechnology has a revolutionary impact on medicine and pharmaceutical sciences. It can play a major role in diagnosis and therapy of cancer, cardiovascular diseases, asthma, hypertension, HIV, diabetes, and infectious diseases. The oral route is associated with the greatest degree of patient compliance (especially for chronic conditions) as it ensures convenience, enables self-administration, and offers great flexibility in dosage regimen. Nanosystems are stable, capable of being functionalized, biocompatible, and directed to specific target sites in the body after systemic administration. Oral products do not require sterile conditions for their manufacture, which reduces production costs. Nanocarriers increase oral bioavailability of drugs due to their specialized uptake mechanisms such as absorptive endocytosis and are able to remain in the blood circulation for a long time, releasing the incorporated drug in a controlled fashion, leading to less plasma fluctuations and minimize side effects. The gastrointestinal (GI) tract offers extensive surface area (300–400 m^2) for drug absorption by absorptive epithelial cells (enterocytes). Nanoscale size nanostructures are able to penetrate tissues and are easily taken up by cells, allowing for efficient delivery of drugs to target sites of action. Uptake of nanostructures has been reported to be 15–250 times greater than that of microparticles in the 1–10 μm range. Various nanotechnology-based drug delivery systems are designed, extensively researched, and explored, viz., liposomes, niosomes, polymeric nanoparticles, and solid lipid nanoparticles. Various designing strategies can be adopted for nanoparticles for different regions of gastrointestinal tract like stomach targeting, small intestine delivery, lymphatic targeting, colon targeting, and

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