

Nanostructures for Diagnostics and Delivery

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Nanostructures are increasingly being recognized for their novel applications in biological systems including nanomedicine—the application of nanoscale technologies for diagnosis, treatment and prevention of diseases. Nanostructures provide high surface area and large surface-to-volume ratio, have controlled shapes and sizes, possess unique thermal, optical, electrical, magnetic and mechanical properties, and can be functionalized by a plethora of chemical or biological molecules. Biomolecular recognition elements (e.g., antibodies, aptamers, peptides and enzymes) attached onto the surfaces of such nanostructures can be used to create novel hybrid systems that can deliver drugs or genes to the targeted cellular or subcellular components or can be utilized to detect pathogens or biomarkers for disease (such as cancer) diagnostics. Functionalized nanostructures can be assembled into hierarchical architectures for developing devices with significantly improved sensitivity and specificity for real-time detection of targeted molecules or biomarker proteins. The compact nature and inexpensive manufacturing processes of nanostructure-based diagnostic devices may ultimately lead to portable and affordable diagnostic tools that can be taken to the point of care—a doctor’s office, a patient’s home or remote locations.