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Engineering nanomaterials: Biomedical applications with nanotoxicological perspectives

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State-of-the-art nanomaterials are at the forefront in emergent arenas of nanotechnology and nanomedicine. Controlled synthesis, unique tunable properties and tranquil surface modification with chemical or biological moieties make engineered nanomaterials appropriate for a variety of biomedical applications. Moreover, designer made nanomaterials display distinctive therapeutic potentials with improved sensitivity, efficiency and specificity and these are due to modified distinctive physicochemical and surface properties of nanomaterials. In addition to above, the designer made nanomaterials has prospective to produce a series of interactions with different biological entities including DNA, proteins, membranes, cells and organelles. Such nano-bio interfacial communications are motivated by colloidal forces and primarily depend on the dynamic physicochemical and surface properties of particular nanomaterial. Nonetheless, contemporary progress and atomic scale tailoring of various physical, chemical and surface characteristics of nanomaterial is promising to dictate their interactions in expected manner with biological units for biomedical applications. Therefore, wisely designed nanomaterials are in extensive demand for a range of applications such as bio-molecular detection and diagnostics, therapeutics, drug and gene delivery, fluorescent labeling, tissue engineering, biochemical sensing and other pharmaceuticals applications. Conversely, the toxicity and hazards concomitant with engineered nanomaterials is rather vague or not well understood. This sort of concerns is gaining considerable attention and the field of nanotoxicology is progressing quickly. Therefore, in this overview lecture, author will reconnoiter current knowledge of articulate engineering of nanomaterials for biomedical applications with special attention on their potential toxicological perspectives.

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