Nanostructures with unique biomedical characterizations in vitro and in vivo

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Abstract: Compared to traditional drug delivery systems, nanostructures have greater potential in many areas, such as precise targeting functionalization, in vivo enhanced imaging, combined drug delivery, longer circulation time and systemically controlled release. Nanostructures incorporating stimulus-responsive biomaterials have remarkable properties which allow them to bypass biological barriers and achieve targeted intracellular drug delivery. Exploring the mechanisms of the interactions between nanostructures and biosystems is an urgent need for future applications of the nanostructures. The interaction of nanostructures with biosystems was well studied at different biological levels, such as: 1. the modifications of bio- macromolecules (protein, gene, lipid, polysaccharide et al) at surface of nanostructures; 2. the interactome of subcellular organelles (lysosome, autophagosome, ER, nuclei et al) with intracellular nanostructures (in vitro); 3.the fate of single cell and population (spheroid, organoid) with nanostructure interaction (ex vivo); 4. the ADMET of nanostructures through physiological barriers (in vivo). The parameters are critical to determine the unique bioeffect of nanostructures behind interaction with biosystems. The optimized parameters will be employed to support the efficient translation of nanostructures from the bench to clinical applications and the approval by the Food and Drug Administration (FDA) for treatment of various diseases. With the exploration of interaction of nanostructures with biosystems, it might be feasible to design even more promising nano-systems synergistic for drug delivery and cancer therapy in the future.