

Systematic Exploration and Modulation of Nano-Bio Interactions

Authors : Bing Yan

Abstract : Nanomaterials are widely used in various industrial sectors, biomedicine, and more than 1300 consumer products. Although there is still no standard safety regulation, their potential toxicity is a major concern worldwide. We discovered that nanoparticles target and enter human cells¹, perturb cellular signaling pathways², affect various cell functions³, and cause malfunctions in animals^{4,5}. Because the majority of atoms in nanoparticles are on the surface, chemistry modification on their surface may change their biological properties significantly. We modified nanoparticle surface using nano-combinatorial chemistry library approach⁶. Novel nanoparticles were discovered to exhibit significantly reduced toxicity^{6,7}, enhance cancer targeting ability⁸, or re-program cellular signaling machineries⁷. Using computational chemistry, quantitative nanostructure-activity relationship (QNAR) is established and predictive models have been built to predict biocompatible nanoparticles.

Keywords : nanoparticle, nanotoxicity, nano-bio, nano-combinatorial chemistry, nanoparticle library

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