# Engineering nanomaterials: Biomedical applications with nanotoxicological perspectives

Hemant Kumar Daima, PhD, Amity University Rajasthan, India

## Abstract

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 (1). 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 (1-4). 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 (1, 5,6). 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 labelling, tissue engineering, biochemical sensing and other pharmaceuticals applications (1-6). Conversely, the toxicity and hazards concomitant with engineered nanomaterials is rather vague or not well understood. This sort of concerns are gaining considerable attention and the field of nanotoxicology is progressing quickly (1). Therefore, in this overview lecture, Dr. Daima will reconnoiter current knowledge of articulate engineering of nanomaterials for biomedical applications with special attention on their potential toxicological perspectives.

## Image

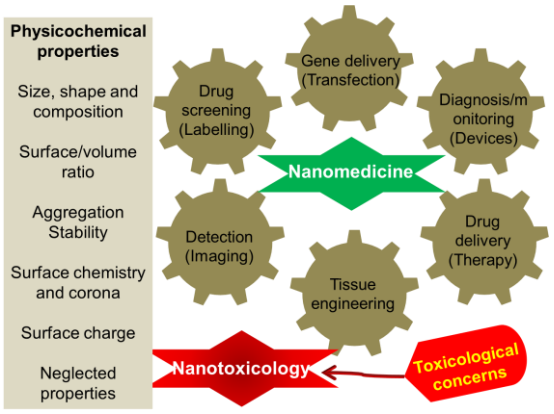



**Figure 1:** Representation of nanomaterials properties which influences their biomedical applications; biomedical applications of nanomaterials and toxicological concerns (nanotoxicology).

## Recent Publications

1. Navya PN, Daima HK (2016). Rational engineering of physicochemical properties of nanomaterials for biomedical applications with nanotoxicological perspectives. Nano Convergence, 3 (1), 1-14.
2. Dubey K, Anand BG, Badhwar R, Bagler G, Navya PN, Daima HK, Kar K (2015). Tyrosine- and tryptophan-coated gold nanoparticles inhibit amyloid aggregation of insulin. Amino Acids, 47 (12), 2551-2560.
3. Shankar S, Soni SK, Daima HK, Selvakannan PR, Khire JM, Bhargava SK, Bansal V (2015). Charge-switchable gold nanoparticles for enhanced enzymatic thermostability. Physical Chemistry Chemical Physics, 17, 21517-21524.
4. Sharma TK, Ramanathan R, Weerathunge P, Mohammadtaheri M, Daima HK, Shukla R, Bansal V (2014). Aptamer-mediated 'turn-off/turn-on' nanozyme activity of gold nanoparticles for kanamycin detection. Chem. Commun., 50, 15856-15859.
5. Daima HK, Selvakannan PR, Kandjani AE, Shukla R, Bhargava SK, Bansal V (2014). Synergistic influence of polyoxometalate surface corona towards enhancing the antibacterial performance of tyrosine-capped Ag nanoparticles. Nanoscale 6 (2), 758-765.
6. Daima HK, Selvakannan PR, Shukla R, Bhargava SK, Bansal V (2013). Fine-tuning the antimicrobial profile of biocompatible gold nanoparticles by sequential surface functionalization using polyoxometalates and lysine. PLoSOne 8 (10), 1-14.



## Biography

Dr. Hemant Kumar Daima is Assistant Professor at Amity Institute of Biotechnology, Amity University Rajasthan, Jaipur, India. He obtained his PhD degree in Applied Biology & Nanobiotechnology from RMIT University, Melbourne, Australia. Dr. Daima has demonstrated importance of surface functionalization to control external corona of nanomaterials, which dictates nanomaterials interaction at Nano-Bio interface. His research findings have revealed guiding principles involved in rational nanoparticle design strategies for biomedical applications. Currently, he is working on development of functional nanomaterials for drug/gene delivery, biosensors, antimicrobial applications (multi-drug resistant bacteria), synthetic nanozyme like activities and medical devices. Dr. Daima has published his research findings in various journals of international repute and presented his research worldwide. He is editorial board member and reviewer of leading international publishers in the field of Nanotechnology, Nanotoxicology and Nanomedicine. Dr. Daima is member of several scientific/professional bodies and recipient of numerous international fellowships/awards.

Email: hkdaima@gmail.com,
hkdaima@jpr.amity.edu

**Notes/Comments:**