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• EDITORIAL •
• SPECIAL TOPIC • Analytical Sciences at the Nano-Bio Interface

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Preface

In the past decade, we have witnessed the rapid development of nanosciences, which have become interdisciplinary and are breaking the classical boundaries of science, technology, and engineering. For example, nanomaterials and nanotechnology have shown immense potential in green printing, energy, environmental remediation, biotechnology, medicine, development of functional materials, information technology, etc.; however, limitations in detection and analytical methods at the nanoscale hinder the progress of nanotechnology from basic research to practical application. The particulate form of nanoparticles indicates that most processes that govern the biomedical or toxicological functions of nanomaterials occur at the nano-bio interface (i.e., the nanosurface and bio-interface). In addition to size, surface, surface charge, shape, etc., the physicochemical properties play synergetic roles in the chemical mechanisms underlying the biomedical properties of nanomaterials. The biomedical processes of nanomaterials during interactions with cells, proteins, tissues, or *in vivo* microenvironments allow for the development of bioanalytical methods that especially meet the demands of ultrahigh spatial resolution, energy resolution, and time resolution, and achieve ultrahigh selectivity (e.g., species selective analyses) in a complex sample system (e.g., the living system and untreated samples of biological systems). Nevertheless, most of the underlying chemical mechanisms are less well studied and are poorly understood owing to the lack of effective analytical techniques.

This special topic focuses on nano-bio analytical approaches recently developed to analyze nano-bio interactions. It includes a coverage of major topics such as, disposable paper-based bipolar electrode array for multiplexed electrochemiluminescence detection of pathogenic DNAs (Xu *et al.*); Recent advances in biological detection with magnetic nanoparticles as a useful tool (Yao and Xiong *et al.*); Dual-calibration coefficient: a more accurate protocol for simultaneous determination of superoxide and hydrogen peroxide in human HepG2 cell extracts (Tang *et al.*); Bio-inspired peptide-Au cluster applied for mercury (II) ions detection (Gao *et al.*); Nanoparticulate X-ray CT contrast agents (Ai *et al.*); Proteomic profiling of protein corona formed on the surface of nanomaterial (Wu *et al.*); Probing the interaction at nano-bio interface using synchrotron radiation-based analytical techniques (Feng *et al.*); Quantifying the dissolution of nanomaterials at the nano-bio interface (Zhang, He and Wang *et al.*). These include original articles as well as methods-oriented review articles that are of broad interest to scientists and industries in the analyses field. We hope this special topic summarizes previous findings and inspires experts to develop novel ideas on the future directions of nano-bio analytical research. However, several knowledge gaps still need to be filled in this field; in particular the design and establishment of *in situ*, real-time analytical methods for living biological systems using "nano" probes. For example, using "nano" probes in the quantitative analyses of a living single cell at a molecular-level resolution in order to obtain real time chemical information during chemical transformations, may greatly improve the sensitivity and selectivity of the method, thus overcoming the limitations, such as intrinsic sensitivity/selectivity, of classical methods. Furthermore, theoretical modeling of structure-activity relationships, which can lead to more rational designs of "nano" probes, has not been sufficiently explored to date and warrants further investigation.

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