

Functional nanoparticles for biomedical applications

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Nanoparticle research has many potential applications, especially in biomedicine by exploiting the fundamental physical properties of materials at the nanoscale.

Professor Ramanathan Nagarajan and I organised a very successful symposium for the 2012 ACS Fall Meeting on “Nanomaterials for Biological, Pharmaceutical and Biomedical Applications”. Then, Professors Sylvie Bégin, Etienne Duguet, Claire Billotey, Dr Puerto Morales and I organised a symposium on a similar theme at the 2013 E-MRS Spring Meeting on “Design of Multifunctional Hybrid Nano-Objects for Biomedical Applications”. From these meetings, it emerged that the functionalisation of nanoparticles is one of the key steps to harness the potential of nanoparticles. Therefore, we would like to capture the most cutting edge research from these two symposia as well as from the wider community on the theme “Functional Nanoparticles for Biomedical Applications”.

The themed issue includes both reviews and research articles and covers a wide range of research. We received many papers of high standard and the reviewing process was very rigorous, as a consequence only a fraction of the papers submitted were accepted for the themed issue.

Magnetic nanoparticles dominate the themed issue, as more and more researchers are now studying them. The research includes fabrication of nanoparticles, their functionalisation for labelling, tracking of cells, encapsulation of anticancer drugs and their release, tumor targeting and bioassays. Magnetic resonance imaging using iron oxide, gadolinium-based and manganese-impregnated mesoporous silica nanoparticles was also covered, as well as upconverting and NIR-emitting rare-earth based nanostructures for NIR-bioimaging.

The noticeable direction of research is that the field has moved further and further towards biology and medicine,

with the biodistribution and pharmacokinetics of magnetite and zinc oxide nanoparticles studied in detail. The interaction with cell media and cellular responses to nanoparticle exposure were also studied. Polymer–DNA conjugate nanoparticles with optical readout and sequence-specific activation of bio-recognition, and the feasibility and constraints of particle targeting using antigen–antibody interaction were featured. Finally I, personally, am impressed with a very novel way of producing bioplatfoms for the encapsulation of theranostic nanomaterials using cell-derived vesicles.

I am very so grateful to co-guest editors Dr Morales, Professors Billotey, Bégin, Duguet and Nagarajan for their intensive and extensive help with handling the manuscripts, and I would wholeheartedly also like to thank the reviewers for their expertise, hard work and time in contributing to the very high quality papers for this themed issue.

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