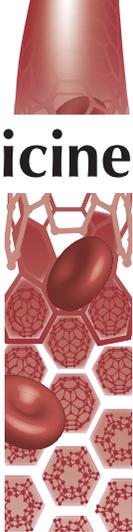


Foreword

For reprint orders, please contact: reprints@futuremedicine.com

Nanomedicine



Exploitation of functional nanomaterials in therapy and diagnostics

“...the scope of this special focus issue is to inform readers about developments in a range of nanomaterials ... and their applications as MRI contrasting agent for diagnostics and therapeutic agents (antitumor and antimalarials).”

First draft submitted: 19 August 2016; Accepted for publication: 14 September 2016; Published online: 21 October 2016

Keywords: 1st Fnmla • academic–industry • functional nanomaterials • international symposium • nanomedicine

The contributors to this special focus issue represent early career researchers to experts in their relative research areas and come from across the world. Their collective contributions provide a current and up-to-date research overview of nanomedicine for health and diagnostics, which was one important theme in the international symposium ‘Functional Nanomaterials in Industrial Applications: Academic – Industry Meet (29–31 March 2016), University of Central Lancashire, Preston, UK’.

This *Nanomedicine* special issue showcases selected research presented by the invited and keynote speakers at the above symposium, organized as part of the dissemination of an on-going international project ‘Functional Hybrid Nanocomposites for the separation of toxic and microbial contaminants from water’ funded by UK–India Education and Research Initiative (UKIERI), attended by academic and industrial organizations across the world. The symposium aimed to discuss three major nano-themed areas *viz*: nano-energy/environment for a better society; nanomedicine for health and diagnostics, and; nanocatalysis for green technology. Around 50 abstracts were received under second theme with only eight manuscripts selected for publication following an intensive peer-review process. An overview of our on-going international UKIERI project (grant no: DST/INT/UK/P-82/2014) and the symposium full

abstract proceedings can be found by browsing the links given in the links provided [1,2]. Specifically, the scope of this special focus issue is to inform readers about developments in a range of nanomaterials, such as superparamagnetic iron oxide nanoparticles (SPIONs), gold-coated nanoparticles/nanorods, nanoparticles entrapped liposomes, protein nanoparticles and bioinspired nanosponges, and their applications as MRI contrasting agent for diagnostics and therapeutic agents (antitumor and antimalarials).

The use of SPIONs as contrast agents and in drug delivery is well established, but the fabrication of ultra-small superparamagnetic iron oxide nanoparticles via a microwave, nonaqueous, sol-gel method for neoangiogenesis T2 MRI contrasting is unique [3]. This is also the case for liposome capped SPIONs [4] in studies of their cellular toxicity in an Alternating Magnetic Field. This special issue also reports for the first time on encapsulation of Ferucarbotran® in erythrocytes and use of the products in magnetic resonance imaging/magnetic particle imaging [5]. Similarly, it illustrates the production of anisotropic gold nanoparticles in photoreponsive fluid possessing utility in UV sensing and erythema prediction and review the synthesis, properties, applications and toxicity of anisotropic gold nanoparticles in general [6,7]. The development and fabrication of nanosponges for the removal of exotoxins



Tapas Sen

Nano-Biomaterials Research Group,
Centre for Materials Science, School
of Physical Sciences & Computing,
University of Central Lancashire, Preston,
PR1 2HE, UK
Tel.: +44 017 7289 4371
tсен@uclan.ac.uk

from mammalian blood [8] is reported as well as the use of a chemical additive in food which can act as an antitumor agent in mice [9]. Finally the development, production and use of protein nanoparticles as antimalarial agents [10] is covered.

The contributors & their work

Contributions to the Special Issue have been managed by Tapas Sen (University of Central Lancashire, UK), Chair of the Symposium [2] and the coordinator of UKIERI project [1]. Sen's work, with that of co-authors Manea Eizadi Sharifabad and Tim Mercer, highlights cellular toxicity of control and drug-loaded liposome-coated SPIONs *in vitro* [4]. In addition, Sen has reviewed a recent trend of drug nanoparticles in suspension for drug delivery [11] with Gurpreet Suri and Amritvir Kaur.

Yoann Lalatonne (Universite Paris 13, and Avicenne Hospital in the Nuclear Medicine Laboratory, Avicenne, France) has been working in the area of biomedical applications of hybrid nanoparticles within the BioNanomaterials team at the Laboratory for Vascular Translational Science for the last 10 years. His work along with that of colleagues involves the synthesis of ultrasmall superparamagnetic iron oxide nanoparticles with tunable sizes for *in vivo* neovascularization MRI, which may play an important role in MRI diagnostics [3].

Mauro Magnani and colleagues (University of Urbino, Urbino, Italy) over the last 10 years have investigated the development and fabrication of new biomimetic constructs consisting of SPION-loaded erythrocytes. They hope this approach may provide a solution to one of the major limitations in the *in vivo* use of SPIONs – their short half-life. Data reported from a murine preclinical animal model show that carrier erythrocytes can increase the half-life of Ferucarbotran from just 1 h to 14 days [5]. Consequently, such an approach could pave the way to the *in vivo* use of SPIONs as contrasting agents for the vascular system.

Nguyen T K Thanh (University College London, in the Biophysics Group at the Department of Physics and Astronomy, London, UK) leads a research team focusing on the design, synthesis and biomedical application of various nanomaterials. In this Special Issue such work involving a plasmonic nanosensor able to detect UV exposure is reported [7]. The material could be an easy-to-use, inexpensive sun light indexing tool for monitoring dangerous levels of skin exposure to UV radiation.

Steve Beeton (University of Central Lancashire, Preston, UK) along with co-author Vikesh Chhabaria using ovine erythrocyte camouflaged nanosponges as a model to test the adsorption of streptolysin-O under tempera-

ture conditions found in human sepsis; this is significant because the material could be used to test the adsorption of other known pore forming toxins, and their interaction with erythrocyte membranes [8]. The model system could be used to develop nanosponge treatment platforms that specifically target a group of disease-causing exotoxins. Nanosponges constructed from other animal erythrocytes could also be synthesized to treat veterinary sepsis and bacteremia in animals.

Jian Zhang and colleagues (Shanghai University of Traditional Medicine, Shanghai, China) studied the reduction of tumor growth in mice by food/chemical compounds [9].

Kamalinder K Singh and colleagues (University of Central Lancashire, Preston, UK) provide research on human serum albumin based nanoparticles for malaria [10]. Human serum albumin is an endogenous protein widely used in the fabrication of nanoparticle/anticancer drug composites, which has had particular commercial success in the form of Abraxane. Abraxane selectively targets an antimalarial drug to malarial parasitized erythrocytes.

The special focus issue's particular benefit to readers

The International Symposium has already been recognized by the international nanotechnology community both from an academic and industrial perspective via websites such as azo-nano [12]. In addition, several commercial entities like Hosokawa Micron Ltd (Cheshire, UK), Feedwater Ltd (Birkenhead, UK), Palo Alto Research Centre (CA, USA), Tata Chemical Ltd (Mumbai, India), who were involved in the program, are already looking at the possibility of commercially exploiting some of the nanomaterials and technology reported here. Finally, the Special Issue highlights the significance and importance of international collaborations typified by those brokered and funded by UKIERI [1].

Dedication

This special issue is dedicated to the Late Professor Harrold Kroto, Noble Laureate in Chemistry, for the discovery of Buckminsterfullerene(s), who died on 30 April 2016, exactly 1 month after the International Symposium. Professor Kroto, an Honorary Fellow at UCLAN, was due to give the Symposium opening talk, which due to ill health was given by Richard Catlow. We all missed his presence and were deeply saddened to hear of his death.

Open access

This work is licensed under the Creative Commons Attribution 4.0 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/>

Financial & competing interests disclosure

The work reported in this Special Issue was and is supported by a UK India Education and Research Initiative (UKIERI) project grant, contract number DST/INT/UK/P-82/2014 as a part project dissemination activity. The author has no other relevant affiliations or financial involvement with any organization

or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

No writing assistance was utilized in the production of this manuscript.

References

- UKIERI project: Multifunctional hybrid nanocomposites for the separation of toxic and microbial contaminants. www.nanowateratuclan.org
- First International Symposium: Functional Nanomaterials in Industrial Applications. 29–31 March 2016. www.nanosymposiumatuclan.net
- Richard S, Eder V, Caputo G *et al.* USPIO size control through microwave non-aqueous sol-gel method for neo-angiogenesis T2 MRI contrast agent. *Nanomedicine (Lond.)* 11(21), 2769–2779 (2016).
- Sharifabad ME, Mercer T, Sen T. Drug-loaded liposome-capped mesoporous core-shell magnetic nanoparticles for cellular toxicity study. *Nanomedicine (Lond.)* 11(21), 2757–2767 (2016).
- Antonelli A, Sfara C, Weber O *et al.* Characterization of Ferucarbotran-loaded RBCs as long circulating magnetic contrast agents. *Nanomedicine (Lond.)* 11(21), 2781–2795 (2016).
- Li N, Zhao PX, Astruc D. Anisotropic gold nanoparticles: synthesis, properties, applications, and toxicity. *Angew. Chem. Int. Ed. Engl.* 53(7), 1756–1789 (2014).
- Pallares RM, Wang Y, Lim SH, Thanh NTK, Su X. Growth of anisotropic gold nanoparticles in photoresponsive fluid for UV sensing and erythema prediction. *Nanomedicine (Lond.)* 11(21), 2845–2860 (2016).
- Chhabaria V, Beeton S. Development of nanosponges from erythrocyte ghosts for removal of streptolysin-O from mammalian blood. *Nanomedicine (Lond.)* 11(21), 2797–2807 (2016).
- Zhang J, Chou G, Liu Z, Liu M. Employing rubusoside to improve the solubility and permeability of antitumor compound betulonic acid. *Nanomedicine (Lond.)* 11(21), 2829–2844 (2016).
- Sidhaye AA, Bhuran KC, Zambare S, Abubaker M, Nirmalan N, Singh KK. Bio-inspired artemether loaded human serum albumin nanoparticles for effective control of malaria-infected erythrocytes. *Nanomedicine (Lond.)* 11(21), 2809–2828 (2016).
- Suri G, Kaur A, Sen T. A recent trend of drug nanoparticles in suspension for drug delivery. *Nanomedicine (Lond.)* 11(21), 2861–2876 (2016).
- Azonano: Massive success for nano-symposium. 29 April 2016. www.azonano.com/news.aspx?newsID=34593