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Platform technologies for accelerating the translation of nanomedicine

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Cancer remains a leading cause of death worldwide. Approximately 8.2 million people died from cancer in 2012, and new cancer diagnoses are expected to increase from 14 million in 2012 to 22 million within the next two decades. Multifunctional nanoparticles hold tremendous promise for cancer diagnosis and treatment, by incorporating targeting, stimuli-responsive release and imaging functions to achieve targeted delivery, controlled release and real-time diagnosis. They have attracted significant interest and undergone an explosive growth over the last decade. However, the majority of nanoparticles have not reached the clinic due to two main barriers: (1) more functionality requires more synthetic steps, resulting in not only difficulty in reproducibly synthesizing nanoparticles having consistent properties, but also low yields and high production cost and high probability of failure during synthesis; (2) high complexity means more convoluted behavior and effects *in vivo*, difficulties in understanding interactions between nanoparticles and biological systems. To address these fundamental issues, my lab has been focusing on the development of facile one-step or one-pot approaches for producing multifunctional nanoparticles for targeted drug delivery. A combinatorial multifunctional liposomes and polymeric nanoparticles have been fabricated with well controlled properties including particle sizes, zeta potential, targeting ligand density, etc., using a robust and reproducible one-step method. Their biological functions were systematically investigated to screen the optimal formulation having the best tumor specificity using *in vitro* 2D monolayer cell culture and 3D tumor spheroids model in comparison with *in vivo* experiments. On the other hand, we have also developed *in vivo* mimicking chips to speed up the evaluation of the library of nanoparticles.

Biography

Chun-Xia Zhao is an Australian Research Council (ARC) Future Fellow and Associate Group Leader at Australian Institute for Bioengineering and Nanotechnology at The University of Queensland, Australia. She leads a research team with a focus on bio-inspired engineering and microfluidics. She has been focusing on innovative research as evidenced by her four patents. Her research has attracted more than $2.5 M in research funding since 2011, including four Australian Research Council projects as the Lead Investigator, two national prestigious fellowship, and six UQ grants. She has been recognized for scientific excellence with a 2016 UQ Foundation Research Excellence Award. She has built extensive collaborations with scientists at top universities such as Harvard University, Cornell University, etc. She was invited to visit Harvard University as a Fellow of the School of Engineering and Applied Science. She also serves as the Editor-in-Chief and Editorial Board Member for several journals.

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