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Targeted nanodelivery to treat chronic kidney disease: Nanomaterial design, response of podocytes and the role of glomerular filtration barrier

Francesco Cellesi
Politecnico di Milano, Italy

Chronic kidney disease (CKD) is a worldwide health threat characterized by a gradual loss in renal function, which often progresses to maintenance dialysis treatment and renal transplantation. The majorities of kidney diseases that lead to CKD starts in the glomerulus, where podocytes, highly specialized polarized cells, are damaged and fail to guarantee selective permeability of the glomerular filtration barrier. CKD drugs are known to have a direct action on podocytes, however they are charged by severe side effects, particularly when a systemic prolonged administration is required. The goal of this work was to develop novel targeted therapies directed to treat glomerular diseases of the kidney. New polymeric nanocarriers as well as liposomal nanoformulations were designed and synthesized to facilitate drug permeation through the glomerular filtration barrier, in order to target podocytes, aiming at reducing dose regime and systemic side effects to CKD patients. New engineered polymeric nanocarriers were synthesized by emulsion polymerization and controlled-living polymerization techniques and produced with a fine tuning of key properties such as size, degradability, surface chemistry, drug loading and release. Alternatively, functional liposomal formulations were also investigated as targeted nanodelivery systems. The effects of these nanomaterials on two-dimensional and three-dimensional cultures of glomerular cells were evaluated *in vitro*, in order to predict the effect of nanodelivery on glomerular filtration repair. Nanomaterial biodistribution, accumulation and permeability in the kidney glomerulus were assessed in animal models under physiological and pathological conditions.

Biography

Francesco Cellesi is Associate Professor at Politecnico di Milano, and Group Leader at Fondazione CEN-European Centre for Nanomedicine, Milan, Italy. He obtained a PhD at the Institute of Biomedical Engineering, ETH Zurich (CH), in 2003, and in 2006 he became Lecturer of Pharmaceutical Biomaterials at the School of Pharmacy, University of Manchester, UK. His research interests focus on nanomedicine, including polymeric nanomaterials, drug delivery, cell microencapsulation and tissue engineering, and materials science and process engineering.

francesco.cellesi@polimi.it

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