COMBINATORIAL NANOCONSTRUCTS FOR BIOMEDICAL IMAGING AND DRUG DELIVERY

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Over the last 15 years, a plethora of materials and different formulations have been proposed for the realization of nanomedicines. Yet, drug loading efficiency, sequestration by phagocytic cells and tumor accumulation are sub-optimal. This implies that radically new design approaches are needed to push forward the clinical integration of nanomedicines, overcoming well-accepted clichés. Combinatorial nanoconstructs are particle-based nano-scale systems designed for the 'smart' delivery of therapeutic and imaging agents.[1-4] The Laboratory of Nanotechnology for Precision Medicine (nPMed) at IIT synthesizes combinatorial nanoconstructs, made out of polymers, with different sizes, ranging from a few tens of nanometers to a few microns; shapes, including spherical, cubical and discoidal; surface properties, with positive, negative, neutral coatings; and mechanical stiffness, varying from that of cells to rigid, inorganic materials, such as iron oxide. These are the 4S parameters – size, shape, surface, stiffness – which can be precisely tuned in the synthesis process enabling disease- and patient-specific designs of multifunctional nanoconstructs. The role of manipulating these 4S parameters over different temporal and length scales will be elucidated in the context of future nanomedicines using in silico, in vitro and in vivo assays.

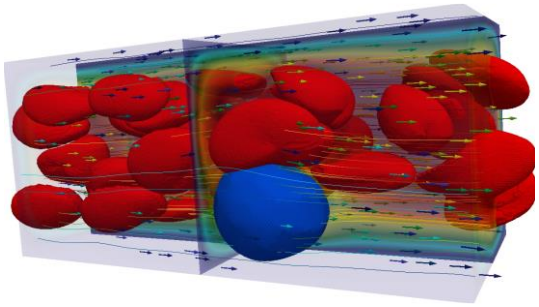

Figure 1 – 3D in silico modeling of deformable particle and cell transport in capillary flow.

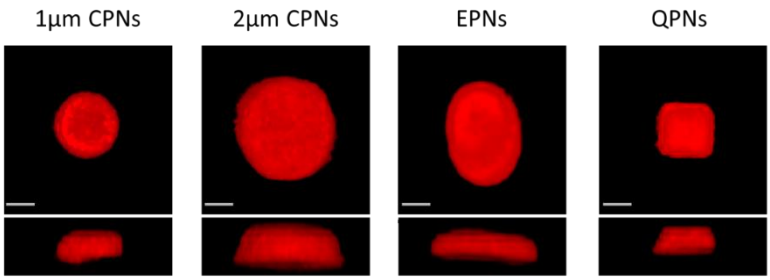

Figure 2 – Combinatorial nanoconstructs with different size and shape made out of PLGA and PEG and loaded with Rhodamine B (red fluorescence).

E*ssential Bibliography*
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