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CELL AND NANOPARTICLE TRANSPORT IN TUMOR MICROVASCULATURE: THE ROLE OF SIZE, SHAPE AND STIFFNESS

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Nanomedicine is a promising method to directly deliver drug molecules into the diseased area. One of the most promising way among these is the targeted delivery of drugs and imaging agents using drug carrier-based platforms. Such drug delivery systems can now be made from a wide range of different materials, in a number of different shapes, coated with an array of different ligands, all leading to enhancements in delivery efficacy and specificity compared to previous delivery methods. Emerging integrated multiscale experiments, models, and simulations opened the door for endless medical applications. The current bottleneck in design of the drug-carrying particles is lack of knowledge about their dispersion in the microvasculature. We will show how drug carriers disperse in the microvessel through multiscale modeling technique. The immersed molecular finite element method (IMFEM) is used to simulate the whole blood including blood plasma, red blood cells and nanoparticles and *in vitro* and *in vivo* experiments are carried out to show how predictive IMFEM is in blood flow simulations [1,2]. Together with a Bayesian updating algorithm, nanoparticle transport in a tumor microvasculature is predicted by combining the blood flow in the short microvessel and statistical input conditions in the entire microvasculature [2,3]. Using this method, we elucidate how the size, shape and stiffness of nanoparticles will affect their dispersions in the microvasculature, with the accurate molecular interactions informed by our molecular mean–field theory [4].

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