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Transport of Brownian spheroidal nanoparticles in near-wall vascular flows for cancer therapy[1] TIRAS Y. LIN, PREYAS N. SHAH, BRYAN R. SMITH, ERIC S.G. SHAQFEH, Stanford University — The microenvironment local to a tumor is characterized by a leaky vasculature induced by angiogenesis from tumor growth. Small pores form in the blood vessel walls, and these pores provide a pathway for cancer-ameliorating nanoparticle drug carriers. Using both simulations and microfluidics experiments, we investigate the extravasation of nanoparticles through pores. Using Brownian dynamics simulations, we evolve the stochastic equations for both point particles and finite-size spheroids of varying aspect ratio. We investigate the effect of wall shear flow and pore suction flow (Sampson flow) on the extravasation process. We consider pores of two types: physiologically relevant short pores with a length equal to the particle size and long pores which are relevant to diffusion through membranes. Additionally, we perform microfluidics experiments in which the extravasation rates of various nanoparticles tagged with fluorescent dye through pores are measured. In particular, using fluorometry we measure the flux of nanoparticles across a track-etched membrane, which separates two chambers. Our preliminary results indicate that the flux measured from experiment agrees reasonably with the simulations done with long pores, and we discuss the effect of pore length on extravasation.

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