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Particle Size, Magnetic Field, and Blood Velocity Effects on Particle Retention in Magnetic Drug Targeting ERICA CHERRY, PETER MAXIM, JOHN EATON, Stanford University — Magnetic drug targeting (MDT) is a promising cancer treatment technique in which magnetic drug particles are steered through the blood stream or held near a tumor site using external magnetic fields. A physics-based model of a general MDT system was developed with the goal of realizing the practical limitations of MDT when electromagnets are the source of the magnetic field. The simulation tracks magnetic particles subject to gravity, drag force, magnetic force, and hydrodynamic lift in specified flow fields and external magnetic field distributions. A model problem was analyzed to determine the effect of drug particle size, blood flow velocity, and magnetic field gradient strength on efficiency in holding particles stationary in a laminar Poiseuille flow modeling blood flow in a medium-sized artery. It was found that particle retention rate increased with increasing particle diameter and magnetic field gradient strength and decreased with increasing bulk flow velocity. The results suggest that MDT systems with electromagnets are unsuitable for use in small arteries because it is difficult to control particles smaller than about 20 microns in diameter.

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