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Controlling the motion of vesicles along compliant substrates ROLF VERBERG, ALEXANDER ALEXEEV, ANNA BALAZS, University of Pittsburgh — To perform various biological assays and tissue engineering studies, it is vital to control the dynamic behavior of in vitro cells. In particular, there is a need for "smart" surfaces that can effectively modulate the motion of cells and thereby allow them to be readily sorted, isolated or encapsulated. To design such smart surfaces, one needs models that capture not only the fluid-membrane interactions, but also cell-substrate interactions. We present an approach that couples mesoscale models for hydrodynamics (lattice-Boltzmann) and micromechanics (lattice spring) to examine the dynamic interactions among an encapsulated fluid, the bounding elastic shell (membrane) and a compliant surface. By focusing on compliant surfaces, we find that simple modifications permit significant control over the motion of cells. In particular, we isolate systems that affect not only the cell's velocity, but also its way of moving along the surface. In addition, we uncover surface patterns that can drive the cells to stop at specified locations. Our findings yield guidelines for controlling in vitro trafficking of cells on elastic surfaces.

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