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Understanding cell passage through constricted microfluidic channels[1] MARCO A. CARTAS-AYALA, ROHIT KARNIK, Massachusetts Institute of Technology — Recently, several microfluidic platforms have been proposed to characterize cells based on their behaviour during cell passage through constricted channels. Variables like transit time have been analyzed in disease states like sickle cell anemia, malaria and sepsis. Nevertheless, it is hard to make direct comparisons between different platforms and cell types. We present experimental results of the relationship between solid deformable particle properties, i.e. stiffness and relative particle size, and flow properties, i.e. particle's velocity. We measured the hydrodynamic variables during the flow of HL-60 cells, a white myeloid cell type, in narrow microfluidic square channels using a microfluidic differential manometer. We measured the flow force required to move cells of different sizes through microchannels and quantified friction forces opposing cell passage. We determined the non-dimensional parameters that influence the flow of cells and we used them to obtain a non dimensional expression that can be used to predict the forces needed to drive cells through microchannels. We found that the friction force needed to flow HL-60 through a microfluidic channel is the sum of two parts. The first part is a static friction force that is proportional to the force needed to keep the force compressed. The second part is a factor that is proportional to the cell velocity, hence a dynamic term, and slightly sensitive to the compressive force.

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