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**On-chip cell sorting via patterned magnetic traps** TOM BYVANK, MICHAEL PRIKOCKIS, AARON CHEN, BRANDON MILLER, JEFFREY CHALMERS, RATNASINGHAM SOORYAKUMAR, Ohio State University — Due to their importance in research for the diagnosis and treatment of cancer, numerous schemes have been developed to sort rare cell populations, e.g., circulating tumor cells (CTCs), from a larger ensemble of cells. Here, we improve upon a previously developed microfluidic device (Lab Chip 13, 1172, (2013)) to increase throughput and sorting purity of magnetically labeled cells. The separation mechanism involves controlling magnetic forces by manipulating the magnetic domain structures of embedded permalloy microdisks with weak external fields. These forces move labeled cells from the input flow stream into an adjacent buffer flow stream. Such magnetically activated transfer separates the magnetic entities from their non-magnetic counterparts as the two flow streams split apart and move toward their respective outputs. Purity of the magnetic output is modulated by the withdrawal rate of the non-magnetic output relative to the inputs. A proof of concept shows that CTCs from metastatic breast cancer patients can be sorted, recovered from the device, and confirmed as CTCs using separate immunofluorescence staining and analysis. With further optimizations, the channel could become a useful device for high purity final sorting of enriched patient cell samples.

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