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On-chip Magnetic Separation and Cell Encapsulation in Droplets A. CHEN, T. BYVANK, A. BHARDE, B.L. MILLER, J.J. CHALMERS, R. SOORYAKUMAR, The Ohio State University, W.-J. CHANG, University of Wisconsin-Milwaukee, R. BASHIR, University of Illinois at Urbana-Champaign — The demand for high-throughput single cell assays is gaining importance because of the heterogeneity of many cell suspensions, even after significant initial sorting. These suspensions may display cell-to-cell variability at the gene expression level that could impact single cell functional genomics, cancer, stem-cell research and drug screening. The on-chip monitoring of individual cells in an isolated environment could prevent cross-contamination, provide high recovery yield and ability to study biological traits at a single cell level These advantages of on-chip biological experiments contrast to conventional methods, which require bulk samples that provide only averaged information on cell metabolism. We report on a device that integrates microfluidic technology with a magnetic tweezers array to combine the functionality of separation and encapsulation of objects such as immunomagnetically labeled cells or magnetic beads into pico-liter droplets on the same chip. The ability to control the separation throughput that is independent of the hydrodynamic droplet generation rate allows the encapsulation efficiency to be optimized. The device can potentially be integrated with on-chip labeling and/or bio-detection to become a powerful single-cell analysis device.

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