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Chip-based magnetic cytometer for high-throughput cellular profiling in unprocessed biological samples DAVID ISSADORE, JAEHOON CHUNG, HUILIN SHAO, MONTY LIONG, RALPH WEISSLEDER, HAKHO LEE, Massachusetts General Hospital / Harvard Medical School — Quantitative, high-throughput measurement of biomarkers in individual cells is a cornerstone of biomedical research, but prohibitive size, cost, and requisite sample processing have kept this technology from being more widely adapted in the clinic. We have developed a miniaturized magnetic cytometer (μ MCM), a hybrid semiconductor / microfluidic chip, to rapidly measure the magnetic moments of individual immunomagnetically tagged cells. The use of magnetic detection enables measurements to be done on native specimens, thus decreasing the loss of rare cells and removing the need for expensive sample processing equipment. Benefiting from the high speed and sensitivity of semiconductor technology, the μ MCM offers high-throughput operation (upwards of 10^7 cells/sec) with a detection resolution of ~ 2000 magnetic nanoparticles/cell. The clinical utility of the μ MCM was demonstrated by detecting scant tumor cells (20 cells) in whole blood and by molecularly profiling cells from solid tumor to monitor longitudinal drug efficacy.

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