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Cell and Droplet Sorting with Surface Acoustic Waves in Microfluidics

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We describe a novel microfluidic cell sorter which operates in continuous flow at high sorting rates.

The device is based on a surface acoustic wave cell-sorting scheme and combines many advantages of fluorescence activated cell sorting (FACS) and droplet sorting in microfluidic channels (FADS).

It is fully integrated on a PDMS device, and allows fast electronic control of cell diversion.

We direct cells by acoustic streaming excited by a surface acoustic wave which deflects the fluid independently of the contrast in material properties of deflected objects and the continuous phase; thus the device underlying principle works without additional enhancement of the sorting by prior labelling of the cells with responsive markers such as magnetic or polarizable beads. Single cells are sorted directly from bulk media at rates as fast as several kHz without prior encapsulation into liquid droplet compartments as in traditional FACS. We have successfully directed HaCaT cells (human keratinocytes), fibroplasts from mice and MV3 melanoma cells. The low shear forces of this sorting method ensures that cells survive after sorting.