Detecting circulating tumor cells

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A proof-of-concept device is nearly perfect in separating breast cancer cells from blood.

About 1 in 4 deaths in the United States are due to cancer, but primary tumors are rarely fatal. Instead, it's when tumors metastasize that cancer becomes so deadly. To help patients and physicians make treatment decisions, teams of researchers have been working on various methods to detect cancer's spread – via the bloodstream – before secondary tumors develop. Now, one team reports a nearly perfect method for separating breast cancer cells from blood. They describe their proof-of-concept device in a paper accepted for publication in *Biomicrofluidics*.

Detecting and separating circulating tumor cells (CTCs) is like finding the proverbial needle in a haystack: as few as one in a billion cells in a patient's bloodstream may be a CTC. Separation techniques vary widely, relying on differences in chemical, paramagnetic, or dielectric properties to distinguish CTCs from blood cells, or using mechanical sieves to cull the larger CTCs from the smaller blood cells. More recently, researchers have applied forces to fluid containing both blood cells and CTCs, using differences in inertia to sort cells. The technique, called "hydrodynamic sorting," is faster and easier than other sorting techniques. Like other mechanical techniques, it also allows researchers to collect viable cells after sorting them.

The team employed hydrodynamic sorting to develop their new device, called a multi-stage, multi-orifice flow fractionation (MS-MOFF) system. A previous design by the same team had just a single stage for

applying hydrodynamic forces, but by adding an additional stage – so the output of the first stage becomes the input to the second stage – the researchers improved the separation efficiency of CTCs from 88.8% to 98.9%. Required pretreatment of the samples still makes MS-MOFF a proof-of-concept device, but the researchers suggest several ways to overcome such limitations and so make it useful for clinical applications.

More information: "Continual collection and re-separation of circulating tumor cells (CTCs) from blood using multi-stage multi-orifice flow fractionation," is published in *Biomicrofluidics*. bmf.aip.org/resource/1/biomgb/v7/i1/p014105_s1

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