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Tiny channel cleanses blood

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Margination, the natural phenomenon where bacteria and leukocytes (white blood cells) move toward the sides of blood vessels, is the inspiration for a novel method for treating sepsis, a systemic and often dangerous inflammatory response to microbial infection in the blood.

A team of researchers at the Massachusetts Institute of Technology and the National University of Singapore has designed a branchlike system of microfluidic channels, 20 micrometers (20 millionths of a meter, or about one-fifth the size of a grain of sand) high by 20 micrometers wide, that mimic the marginizing action of vessels on bacteria and inflammatory cellular components (leukocytes and platelets) to separate them from red blood cells.

The microchannel network is etched onto a polymer chip by the same techniques used for manufacturing integrated circuits. As infected whole blood flows through the first part of the microchannel, red cells migrate toward the center while the unwanted cell types flow toward the side walls. Like a biological railway junction, the second part of the microchannel is divided into three branches with red cells taking the middle path and the marginated microbes, leukocytes, and platelets moving into the two outer ones. A second three-branch junction further purifies the red cell fraction, which could then be returned to a patient in a real-life situation.

In their experiment with the prototype device, the researchers demonstrated highly efficient removal of the bacteria *Escherichia coli* (80 percent) and the yeast *Saccharomyces cerevisiae* (90 percent) as well

as a greater than 80 percent depletion of inflammatory cellular components. The researchers also designed and tested a larger blood cleansing system consisting of six microfluidic channel networks in parallel.

Currently, they are conducting a small-scale animal test to validate the efficacy of the technique in vivo. Article "A microfluidics approach towards high-throughput pathogen removal from blood using margination" is accepted for publication in *Biomicrofluidics*.

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