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Following The Flow In Microchannels

Remote-detection MRI and NMR yield detailed information about chemistry and fluid flow within microscopic structures

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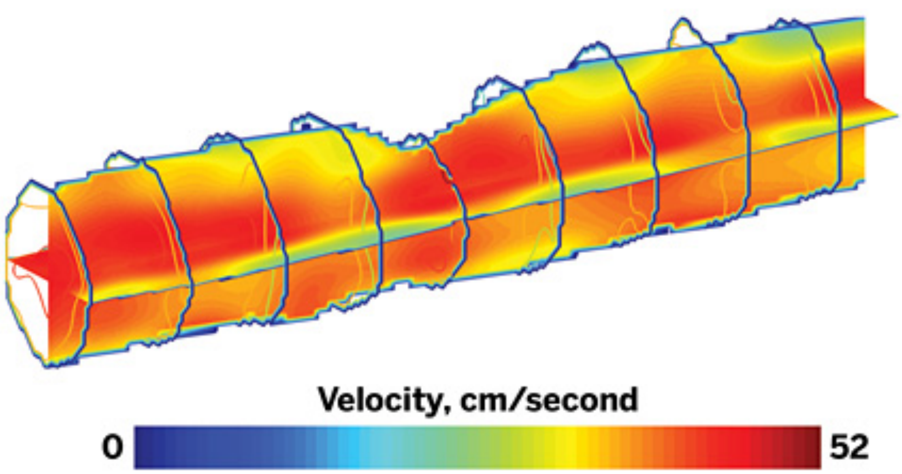
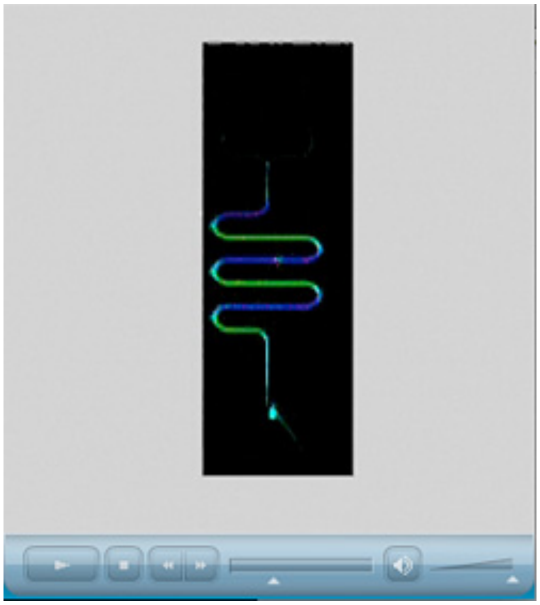


Science

An MRI image shows how liquid flow diverts around a constriction in a 140-µm-diameter microfluidic channel, similar to what might occur at a valve.


Science

ZOOMED IN MRI imaging of water flowing through a serpentine mixer shows how fluid velocity slows around the curves (blue and green, 20 cm/second; aqua, 0 cm/second).

* Macromedia Flash Player 8 is required to view videos.

Detailed information about chemistry and fluid flow within microscopic structures such as microfluidic channels or blood vessels is now possible using a remote-detection approach to magnetic resonance imaging or nuclear magnetic resonance spectroscopy (*Science,* DOI: 10.1126/science.1192313). Developed in the lab of Alexander Pines at the University of California, Berkeley, remote detection involves encoding magnetic resonance information into the nuclear spins of the analytes flowing through a microfluidic channel or other structure. The information is then read at a detector stationed at the channel outlet. Pines, Vikram S. Bajaj, and colleagues have now extended the technique to enable the use of a standard macroscopic magnetic coil to obtain information on the flow and velocity of liquids in microfluidic devices down to a spatial resolution of 15 µm—something that previously would have required stationing microscopic coils along the device channels. This approach may also be used to obtain flow information for fluids in microporous materials or in blood vessels in vivo, the researchers say, or NMR chemical shifts for compounds involved in high-throughput studies of cellular metabolism or in small-molecule screening.

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