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Shake, rattle, and roll: microstreaming flows from acoustically oscillating cells[1] SCOTT TSAI, ALINAGHI SALARI, SILA APPAK-BASKOY, MICHAEL KOLIOS, Ryerson University — Steady-state microstreaming flows can arise from the interaction of sound waves with elastic objects, such as bubbles. Such microstreaming finds utility in cell and particle manipulation, and in microfluidic pumping and analyte mixing. Here, we describe a new observation that in vitro single cells that are excited by a controlled acoustic wave are also able to generate microstreaming flows. Specifically, adherent cells under the influence of a surface acoustic wave oscillate inside a microfluidic channel to generate microstreaming flows. We study the cellular properties that affect the degree of microstreaming by, for example, imposing an osmotic shock to the cell, manipulating the cell structure enzymatically using trypsin, and chemically, using paraformaldehyde and Cytochalasin D. Our findings suggest that the microstreaming induced by MDA-MB-231 cells is primarily controlled by the overall cell stiffness. We thus conclude that measuring the resulting flow pattern and velocity magnitude may be utilized as a label-free proxy for quantifying the mechanical properties, such as stiffness, of the cell.

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