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Cell Permeabilisation and Transport Focused Around Oscillating Microbubbles

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The ultrasound-driven oscillation of a microbubble drives a steady streaming focused around the bubble. The study of individual bubbles attached to a wall shows vivid recirculations. When cells are in the vicinity of these bubbles, also used in medecine as contrast agent for ultrasound echography, they experience considerable shear rates. We introduce in the flow giant unilamelar lipid vesicles, acting as artificial cells. Rupture of the lipidic membrane with the opening of pores is revealed by high-speed camera recordings. A reversible permeation of the membrane wall can also be obtained, demonstrating at the micron scale the efficiency of microbubbles to deliver drugs in cells. The streaming flow of bubble on a surface can be further controlled, with the adjunction of a solid obstacle nearby: the flow turns to be directed. We will present a microfluidic device using the principle of bubble/obstacle doublets to locally transport small objets such as cells.

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