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*Abstract*

# Elasto-Magnetic Pumps Integrated within Microfluidic Devices †

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**Abstract:** Many lab-on-a-chip devices require a connection to an external pumping system in order to perform their function. While this is not problematic in typical laboratory environments, it is not always practical when applied to point-of-care testing, which is best utilized outside of the laboratory. Therefore, there has been a large amount of ongoing research into producing integrated microfluidic components capable of generating effective fluid flow from on-board the device. This research aims to introduce a system that can produce practical flow rates, and be easily fabricated and actuated using readily available techniques and materials. We show how an asymmetric elasto-magnetic system, inspired by Purcell's three-link swimmer, can provide this solution through the generation of non-reciprocal motion in an enclosed environment. The device is fabricated monolithically within a microfluidic channel at the time of manufacture, and is actuated using a weak, oscillating magnetic field. The flow rate can be altered dynamically, and the direction of the resultant flow can be controlled by adjusting the frequency of the driving field. The device has been proven, experimentally and numerically, to operate effectively when applied to fluids with a range of viscosities. Such a device may be able to replace external pumping systems in portable applications.

**Keywords:** elasto-magnetic; microfluidic; lab-on-a-chip; pump

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