# Actuation Method and Apparatus, Micropump, and PCR Enhancement Method

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## Technology description

The MSM micropump is compatible with forensic applications, specifically DNA profiling. It enhances polymerase chain reaction (PCR), which is a scientific technique used to create multiple copies of a particular DNA sequence. When the PCR reagent and DNA material contact with an MSM element, the DNA amplification is greater than would occur without the contact with MSM. The micropump is also suitable for lab-on-a-chip applications that require microfluidics.

The lab-on-a-chip revolution has produced a number of innovations that herald a new age of portable field instruments and point of care diagnostics. Micro total analysis systems incorporate a variety of traditional material such as glass and silicone, but other materials are now being widely adopted. Many functional components for these miniaturized devices have been developed for biological testing including homogenizers, cell disruptors, antigen binders, laser detectors, heaters, electrophoretic separators, mobility analyzers, etc. and there is a trend toward self-contained disposable chips for clinical use. Less development has occurred in the area of micropumps, with many devices still being driven by external traditional peristaltic pumps or syringes. A micropump has been developed that primarily consists of a single component, MSM (Magnetic Shape Memory). MSM contains a material that responds to changes in magnetic fields by elongating and shortening, and thus pumps the fluid through the micropump. The pump can be driven by rotation of a cylindrical magnet, or by electrical rotation of a magnetic field, making the pump wireless. The MSM micropump can pump in both directions and can be effectively operated by hand without any electrical power.

## Advantages

The MSM micropump is simpler, more precise in dosing, faster in pumping, and less expensive than known micropumps. The MSM micropump can pump in both directions and does not need valves. The pump is powered by external magnetic field sources and is therefore wireless and contact-free. The micropump does not require any electrical or physical contact with the pump driver, and therefore can be a sealed and disposable component for clinical and field applications. The MSM pump is compatible with biological testing and increases PCR yield in forensic profiling.

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