Rapid immunoassays exploiting magnetic nanoparticles and micro-magnets

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PHD GRANT

Magnetic attraction is widely used in *in vitro* diagnostics, as it provides non-contact forces able to capture the objects of interest. Down-scaling the particle size allows diffusion-based transport for much faster reactions; however, due to their high Brownian motion, sub-micrometric superparamagnetic nanoparticles (SPN) are not efficiently trapped by conventional macro-magnets. We exploit high local gradients from micro-magnets to manipulate and locally capture SPNs. We first developed a colorimetric magnetic immunoassay (MagIA), performed in multi-well plates. We then developed a radically innovative, magnetically localized fluorescent detection immunoassay (MLFIA) which allows rapid molecule quantification, without any fluid handling (see Fig.). We optimized MagIA and MLFIA with ovalbumin model, then transferred MLFIA to the detection of clinical parameters (Toxoplasma gondii IgG and IgM) and C reactive protein in human samples. MLFIA presents several key advantages: it is compatible with biological media, uses a small volume and requires little energy. It is also versatile. We are currently developing a portable reader for point-of-care diagnostics. The results will open the way to a new generation of sensitive immunological lab-on-chip.

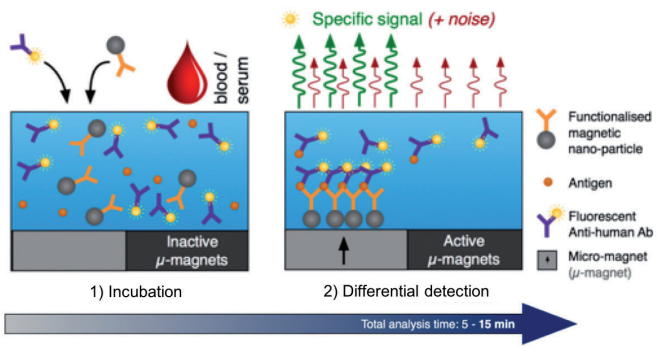

Fig.: Principle of the magnetically localized fluorescent immunoassay.

OUTCOMES

[1] Rapid immunoassay exploiting nanoparticles and micro-magnets, Bioanalysis 9, 517 (2017).

Conference: Poster, Innovative no-wash immunoassay, Intermag, Dublin, Ireland, 2017.

Start-up: Co-founder of MagIA Diagnostics