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Multiplexed serodiagnosis of Chagas disease at the point-of-care using magnetic levitating microbeads

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This talk will describe the point-of-care detection of Chagas disease in whole blood solutions using magnetic levitating microbeads (MLmBs). This simple and label-free diagnostic method can be easily performed by minimally trained personnel using an inexpensive and portable magnetic stage that requires no electricity. The diagnostic method starts by mixing a solution of whole blood containing *T. cruzi* antibodies (Chagas) with diamagnetic microbeads functionalized with p24 proteins. After an incubation time of 40 min, some anti *T. cruzi* antibodies get covalently attached to the p24 proteins coating the microbeads, modifying their density. Shaking the test tube suspends the microbeads in a paramagnetic aqueous buffer, where the beads attached to anti *T. cruzi* antibodies levitate at a different height than the rest once the tube is placed between two anti-aligned permanent magnets with their direction of magnetization perpendicular to gravitational force. When non-polarized light passes through the levitating beads, it is possible to visually identify groups of beads levitating at different heights, detecting the presence of *T. cruzi* antibodies in the sample. Tuning the distance between magnets and the experimental protocol to bind *T. cruzi* antibodies to the microbeads, enables the optimization of the sensitivity of these tests up to the clinically relevant range, with a detection limit appropriate for clinically relevant applications. The small size of the test samples in comparison with the area of the magnets facilitates multiplexed analysis (>100 samples). While these assays are relatively slow (approx. 1h), they have the potential to open new possibilities in point-of-care diagnosis, animal and plant pathology, environmental monitoring, and biochemical analysis in low-resource settings.

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