Development of a Rapid Diagnostic Test for Malaria Antigens Detection using Gold Nanoparticles-Antibody Conjugates

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Our main objective is to design a gold nanoparticle (AuNP)-based rapid diagnostic test (RDT) using monoclonal antibodies to detect *P.falciparum*-specific antigens in clinical samples.
AuNPs are ideal candidates for biosensing assays due to their unique nanoscale properties, such as high surface areas, robustness, facile synthesis and functionalization, and strong, non-bleaching, optical absorptions [1, 2]. These properties are especially interesting for the development of colorimetric molecular assays that are inexpensive, easy to implement and interpret, and can be used in the form of a test-kit [3].
Our assay set intends to go beyond the state-of-the-art in commercially available RDTs, with increased sensitivity and stability imparted by optimized gold nanoparticles.
Gold nanoparticles are functionalized with mercaptoundecanoic acid (MUA), and conjugated with a monoclonal antibody (2G12) that specifically recognizes *Plasmodium falciparum* histidine-rich protein 2 (*Pf*HRP2), a malaria antigen frequently used in RDTs.
Conjugation of the monoclonal antibody with the functionalized AuNP was performed by electrostatic interactions or by covalent attachment, through the available antibody amine groups, allowing the formation of active and robust AuNP-antibody conjugates.
The formation, robustness and binding properties of the AuNP-MUA-2G12 conjugates was evaluated by agarose gel electrophoresis (Figure 1) and zeta potential measurements.
A Western blot analysis was performed to confirm if *Pf*HRP2 can still be recognized by the monoclonal antibody when conjugated with AuNP-MUA.
We have recently started to develop a simple test on a nitrocellulose strip, based on a competitive format. *Pf*HRP2 antigen will be coated on the test zone of the dipstick, capturing the AuNP-antibody conjugate and allowing the red color to concentrate and form a spot (Figure 2).
The immunoassay will be used for detection of a recombinant purified antigen and of the same antigen in malaria-infected *in vitro* blood cultures. This study will constitute an important proof-of-concept for future tests in clinical samples.

References

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Figures

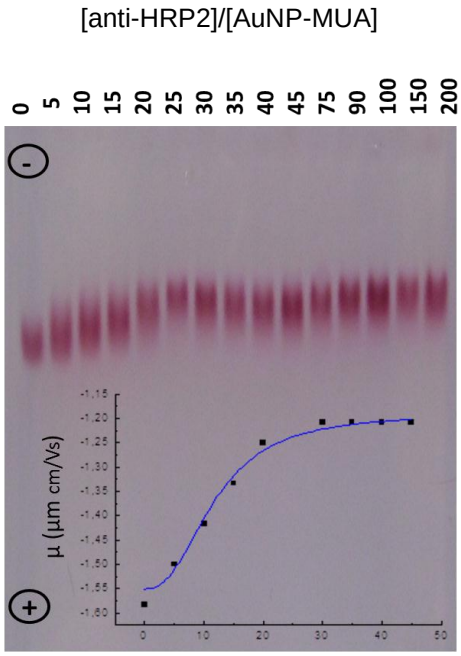

Figure 1 - Agarose gel electrophoresis of AuNP-MUA-anti-HRP2 conjugates. **Inset:** Electrophoretic mobility of the conjugates.

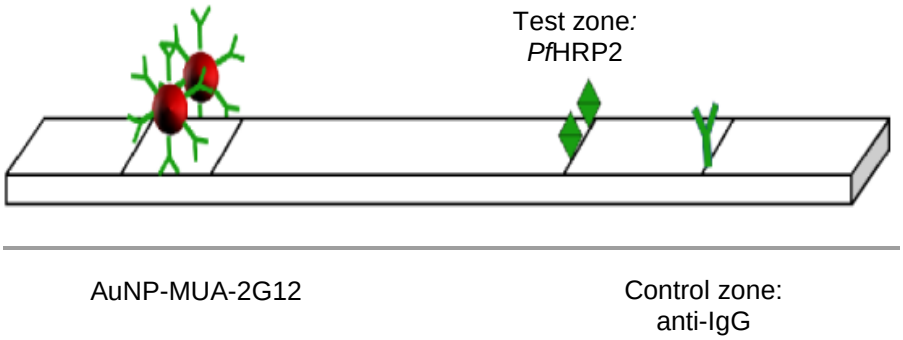

Figure 2 - Schematic representation of the Rapid Diagnostic Test.