Ultrasensitive nucleic acid-based systems: from bench to ready-to-use R&D kit

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The detection of antibodies and other proteins plays a crucial role in the diagnosis of a variety of human diseases. Due to the low concentrations (low nM to pM) at which these biomarkers are usually found in clinical samples, the detection methods need to be not only specific and selective, but also particularly sensitive. To achieve this goal, signal amplification strategies are generally used, such as in the enzyme-linked immunosorbent assay. However, this requires reagent-intensive processes and multiple washing and reaction steps, which leads to relatively high costs and limits the applicability at the point of care (POC). In response to the urgent need for new analytical tools for the rapid, cost-effective, and quantitative measurement of biomarkers, our group has reported several approaches based on different signaling strategies, taking advantage of the programmability and versatility of synthetic DNA.[1-3] However, all these approaches based on the use of antigen-conjugated DNA strands share a common limitation: due to the direct nature of the assay and the lack of amplification step, their sensitivity is in the nanomolar range [4]. In response to the above considerations, we have recently developed an electrochemical platform named “ELIDIS” that combines the programmability and versatility of antibody-responsive DNA strand displacement reactions with the sensitivity of enzyme amplification to achieve ultrasensitive antibody detection.[5] We have demonstrated the sensitive (low picomolar detection limit), specific (no signal is observed in the presence of non-specific antibodies), selective (the platform can be employed in complex media, including 90% serum) and multiplexed detection of five different antibodies, three of which are clinically relevant. Our start-up Fabrica Biosystems is focused on transforming the technology thus developed into a ready-to-use, user-friendly electrochemical and colorimetric kit for practical application at the point-of-care as well as in research and development.

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