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DEVELOPMENT OF CHEMILUMINESCENT SPLIT G-QUADRUPLEX BIOSENSOR FOR ANTIBODY DETECTION

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One of the principal findings of molecular and cellular biology is that cells metabolism and homeostasis are based on networks of interacting proteins, which regulation is often based on noncovalent interactions.[1] Inspired by this mechanism, we developed a proximity based system that take advantage of the antibody-activated assembly of a split DNAzyme G-quadruplex. To this end, DNAzyme split single strands, each functionalized at one end with antigen molecules, have been designed. Their binding to target antibody leads the co-localization of the two DNAzyme split single strands, with a consequent increase of their local concentration. This drives the two split G-quadruplex fragments self-assembly, followed by hemin binding to produce the active G-quadruplex DNAzyme structure, able to catalyze the luminol/H_2O_2 chemiluminescent reaction. We have demonstrated that our approach could be used for different antigen/antibody systems showing high binding affinity, specificity for the target antibody, and selectivity to work. This study highlights the potential of bio supramolecular DNA engineering for the development of innovative rapid bioanalytical assays, aimed at detecting specific antibodies in biological samples for diagnostic purposes.

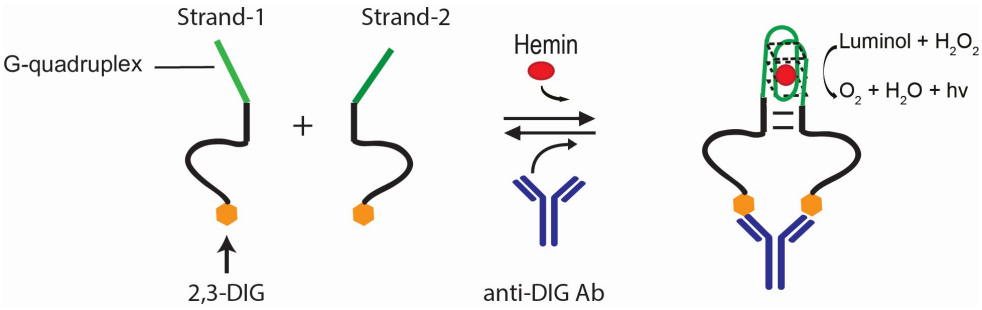

Figure 1. Antibody-templated assembly of the G-quadruplex DNAzyme. In this strategy, DNA G-quadruplex is split into two halves by the ratio of either 4: 8 (green in the figure), and each of the two strands is conjugated with a recognition element (antigen) specific for a target antibody. Only in the presence of the antibody the two fragments are colocalized in a confined space and can reassemble into the functional G-quadruplex DNAzyme structure which, in presence of hemin and luminol, provides a chemiluminescent signal.

References

[1] Grzybowski B. A., Huck W. T. S., Nat. Nanotechnol., 2007, 450, 983-990.