DNA aptamer gold-magnetic nanoconjugates for the detection of Alzheimer's disease biomarkers

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Abstract:

Alzheimer's disease (AD) is the most debilitating form of dementia and ranks among the leading causes of death in older adults. Although its precise onset remains uncertain, research suggests that the underlying pathological changes can start many years—often decades—before noticeable cognitive symptoms appear. Thus, the specific and sensitive detection of easy-to-measure blood biochemical markers (biomarkers) is of the essence. Aptamers are RNA or DNA oligonucleotides that can specifically detect several protein biomarkers. These targets include the ones associated with AD pathology, like amyloid beta (Aβ) peptides Aβ40 and Aβ42, GFAP, markers of inflammation and of coagulation like thrombin. Significantly enough, aptamers can be employed in sensitive biochemical assays as an alternative to the most expensive antibodies. The employment of magnetic nanoparticles can increase the specificity and sensitivity of biomarker detection in magnetism-assisted analyzers. To that end, we employed gold-coated magnetite nanoparticles in order to use them as a platform for the conjugation of specific aptamers for Aβ40, Aβ42, GFAP and thrombin. FAM-modified aptamers were used for the quantitation of the conjugated aptamer. In order to increase conjugation efficiency, several factors were evaluated (aptamer-nanoparticle concentration, pH, salinity). The binding affinity of GFAP and thrombin standard proteins was verified with western blotting and further research is performed for detecting Aβ peptides. These aptamer-gold magnetic nanoparticles are to employed as part of a novel device to perform specific and sensitive measurements for the early diagnosis of AD.

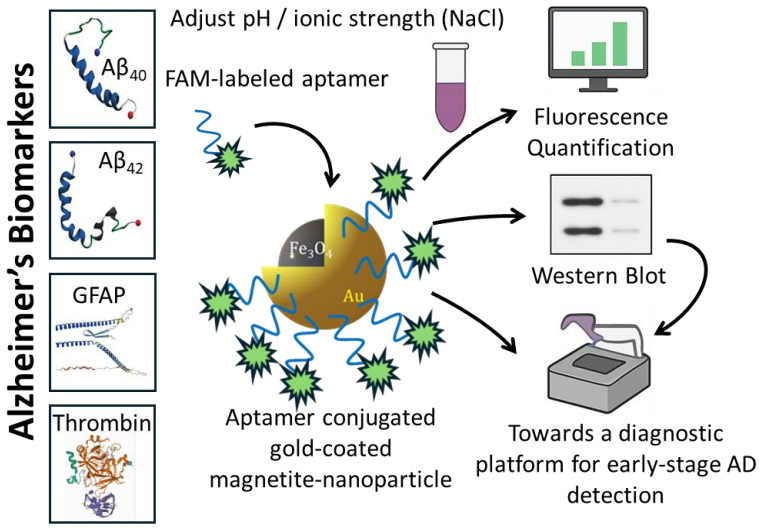

Figure 1: Schematic representation of gold-coated magnetic nanoparticles functionalized with specific aptamers for Aβ40, Aβ42, GFAP and thrombin.

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