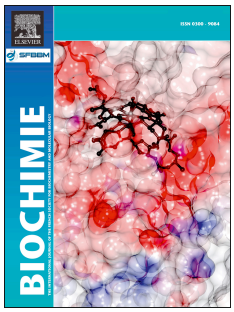
Accepted Manuscript



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PII: S0300-9084(18)30001-4

DOI: 10.1016/j.biochi.2017.12.015

Reference: BIOCHI 5344

To appear in: *Biochimie*

Received Date: 18 July 2017

Accepted Date: 29 December 2017

Please cite this article as: B. Shui, D. Tao, A. Florea, J. Cheng, Q. Zhao, Y. Gu, W. Li, N. Jaffrezic-Renault, Y. Mei, Z. Guo, Biosensors for Alzheimer's disease biomarker detection: A review, *Biochimie* (2018), doi: 10.1016/j.biochi.2017.12.015.

Review

Biosensors for Alzheimer's disease biomarker detection: A review

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Abstract: Alzheimer's disease (AD) is a chronic disease amongst people aged 65 and older. Increasing evidence has illustrated that early diagnosis holds the key to effective treatment of AD. A variety of detection techniques have been developed. Biosensors are excellent analytical tools which have applications in detecting the biomarkers of AD. This review includes appropriate bioreceptors to achieve highly sensitive and selective quantification of AD biomarkers by using transducers. AD biomarkers such as tau protein, amyloid β peptides and apolipoprotein E4, are firstly summarized. The most commonly used bioreceptors, including aptamers and antibodies, are also reviewed. We introduce aptamers specific to AD biomarkers, list the sequences of aptamers designed to capture AD biomarkers and compare the properties of aptamers with those of antibodies with regard to their efficiency as bio-recognition elements. We discuss the recent progress of aptamer systems' applications in AD biomarkers in biosensing. The review also discusses novel strategies used for signal amplification in sensing AD biomarkers.

Keywords: Alzheimer's disease; biomarkers; aptamers; electrochemical biosensors

1. Introduction

AD was discovered as a severe neurodegenerative disorder characterized by progressive memory, cognitive impairment and personality changes, with evolution to dementia and death [1,2]. The symptoms of AD are impairment of memory and other cognitive skills and a gradual loss of much capacity to carry out daily life activities. With accelerated speed of population aging, AD has become an increasingly serious public health concern all over the world. At present, more than 35 million people have been diagnosed with AD, worldwide. The number is expected to double every 20 years in large aging populations: it will reach 65.7 million in 2030, and 115.4 million in 2050 [3]. Nowadays, three best recognized and described biomarkers are considered for routine diagnosis of AD in human cerebrospinal fluid (CSF) and blood: tau protein, amyloid β peptides (Aβ) and apolipoprotein E4 (APOE4). Because biomarker studies will help to better understand the early stages of disease, early detection of AD is the key to taking timely caring measures to avoid the disease and help prevent deterioration of the patient. To date, AD biomarker-based expression techniques include mass spectrometry (MS) [4], magnetic resonance imaging (MRI), enzyme linked immunosorbent assay (ELISA) [5], Western-blot, immunohistochemistry (IHC), flexible Multi-Analyte Profiling (xMAP) [6] and position emission tomography (PET) [7]. Rong Wang et al. [4] determined the Aβ variants by measuring their molecular masses using matrix-assisted laser desorption ionization time-of-flight MS measurements. They