Aptamer-Based Biosensors For Biomarkers Detection (Part I)

A biomarker has been defined as an objectively measurable change arising in biological environments such as body fluids, tissues or human cells. This change may describe the pathological condition or the body’s response to treatment when assessing the effectiveness of pharmacological therapy. Biomarker determination should be performed using a quick, safe and easy diagnostic test, which allows detecting the disease in the phase before the appearance of characteristic clinical symptoms [1, 2].

It is necessary to distinguish between disease-related and drug-related biomarkers. In this Special Issue, we will consider both types of biomarkers, and biosensors are particularly effective in detecting them.

The development of biosensors began in 1962, from the first mentions of the use of biosensors in the publication of Clark and Lyons. Since then, intensive research has been underway, resulting in the development of increasingly advanced, more sensitive and reliable biosensors. Biosensors are usually classified according to the type of signal transmitted, type of transducer, and are divided into electrochemical, electric, acoustic, optical and thermal/calorimetric sensors [3].

Aptamers have been widely used as recognition elements for biosensor construction, especially in the detection of small molecule targets and proteins. Aptamers are short, single-stranded DNA or RNA oligonucleotides that can selectively bind to a specific target. Systematic Evolution of Ligands by EXponential Enrichment (SELEX) is a standard method of selecting aptamers from a large oligonucleotide library. The test medium can be a physiological fluid, including blood, saliva, urine or cerebrospinal fluid [4].

The main purpose of this Special Issue of Current Medicinal Chemistry is to collect the latest and most promising achievements concerning the aptamer-based biosensors for biomarkers detection, particularly those that can be applied in clinical samples.

The first contribution, titled "Electrochemical Aptasensors for Parkinson’s disease Biomarkers Detection”, Mikula et al., discuss the most important clinical biomarkers for Parkinson’s disease, highlighting their physiological role and function in the disease. In this study, the authors review, for the first time, innovative aptasensors for the detection of current potential PD biomarkers based on electrochemical techniques and discuss future alternatives, including ideal analytical platforms for point-of-care diagnostics [5].

The study of Dhand et al. discussed the potential of various 2D material-based aptasensor for diagnostic applications, e.g., protein detection, environmental monitoring, pathogens detection, etc. [6].

The third contribution, titled “Recent advances in the selection of cancer-specific aptamers for the development of biosensors,” by Rodrigues et al. is focused on the most recent advances in cancer biomarkers, achievements and optimizations made in aptamer selection, as well as the different aptasensors developed for the detection of several cancer biomarkers [7].

The fourth contribution of Abdollahi et al. aims to design a simple, quick, precise, and cost-effective method on a biosensor platform to evaluate the low levels of zearalenone in foodstuffs and agricultural products [8].

In the last contribution, “Detection of Prostate Cancer Biomarker PCA3 by using Aptasensors,” by Pedrosa et al. focuses on develop a new aptasensor to detect PCA3 release by the cancer cell. Prostate cancer cells have very high PCA3 messenger RNA levels, which turns them into one of the new biomarkers for prostate cancer prognosis and diagnosis [9].

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