

## Immunosensor for alpha-synuclein detection in Parkinson's Disease

Inês Simões da Silva (1,3), Vera Martinho (1,3), Ana Rita Cardoso\* (1,2,3), Maria Goreti Sales (1,2,3)

1: BioMark@UC, Department of Chemical Engineering, Faculty of Science and Technology, Coimbra University, Coimbra, Portugal; 2: BioMark@ISEP, School of Engineering, Polytechnic Institute of Porto, Porto, Portugal; 3: CEB, Centre of Biological Engineering, Minho University, Braga, Portugal

Parkinson's disease (PD) is a neurodegenerative disorder and one of the leading causes of death worldwide [1]. The principal neuropathological defining hallmark of PD is the presence of Lewy bodies mainly composed of aggregates of alpha-synuclein ( $\alpha$ -syn) [2]. This protein is a specific PD biomarker that, when detected early, can contribute to an effective PD treatment application. Immunosensors are analytical platforms that can detect disease biomarkers with great accuracy [3]. Thus, a selective and sensitive immunosensor to detect  $\alpha$ -syn protein based on a standard screen-printed gold electrode is proposed herein. The sensor assembly was done through three different and sequential steps: (1) incubation with 3-aminophenol (3-AMP) to promote the amination of the gold electrode surface; (2) incubation with the  $\alpha$ -syn antibody; and (3) bovine serum albumin application to avoid non-specific binding. The electrochemical characterization and surface modification was analysed through cyclic voltammetry, electrochemical impedance spectroscopy, and square wave voltammetry techniques. Finally, the performance of this immunosensor was assessed using several calibration curves with standard solutions. The final immunosensor exhibited a linear response from 7 pM to 70 nM. On balance, this immunosensor was characterized as a sensitive, selective, and reproducible platform, with great potential for real sample analysis.

### References:

[1]World Health Organization, Global burden of neurological disorders: estimates and projections, in: WHO (Ed.), *Neurol. Disord. Public Heal. Challenges*, 2006: pp. 878–885. <https://doi.org/10.1001/archneur.1997.00550190066016>.

[2]J.R. Spillantini M. G., Schmidt M. L., Lee V. M., Trojanowski J. Q., and G. M., Alpha-synuclein in Lewy bodies, *Nature*. 388 (1997) 839–840.

[3]M. Aydin, E.B. Aydin, M.K. Sezgintürk, *Advances in immunosensor technology*, *Adv. Clin. Chem.* 102 (2021) 1–62. <https://doi.org/10.1016/bs.acc.2020.08.001>.

**Keywords:** alpha-synuclein; electrochemical immunosensor; 3-electrode system; gold screen-printed electrodes; Parkinson's disease