Early Detection of Alzheimer's Disease Using an Electrochemical Graphene-Based Platform

Ronaldo Challhua[1]
Marianna Rossetti[1], Ruslan Alvarez-Diduk[1], Arben Merkoçi[1,2]
[1]*Nanobioelectronics & Biosensors Group, Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST, Campus UAB, Bellaterra, 08193 Barcelona, Spain.* [2]*Catalan Institution for Research and Advanced Studies (ICREA) Passeig de Lluís Companys, 23, Barcelona, 08010, Spain*
ronaldo.challhua@icn2.cat

Alzheimer's Disease (AD) is the most common type of dementia [1], currently relies on diagnostic methods that are expensive, invasive, or time consuming. These methods, based on blood biomarkers, still face challenges, and the design of cost-effective and simple testing protocols remains a significant barrier [2].

Here, we propose a novel, cost-effective Point-of-Care (PoC) system designed for early AD diagnosis and progression. Leveraging a low-cost green IR-laser-assisted print/stamp technology, we fabricate reduced graphene oxide (rGO) electrodes that can be integrated into lateral flow assay (LFA) strips [3]. These rGO electrodes can be functionalized with aptamers that specifically bind to key AD biomarkers e.g. Glial Fibrillary Acidic Protein (GFAP). Binding events between the aptamers and target biomarkers induce detectable changes in the electrochemical signal, allowing for rapid, sensitive, and reliable detection.

This PoC system provides a promising, non-invasive approach to AD diagnostics, offering a streamlined, accessible solution for early detection and disease management.

Acknowledgements

The ICN2 is funded by the CERCA programme/Generalitat de Catalunya. The ICN2 is supported by the Severo Ochoa Centres of Excellence programme, Grant CEX2021-001214-S, funded by MCIU/AEI/10.13039.501100011033. We acknowledege Departament de Recerca i Universitats of Generalitat de Catalunya for the grant 2021SGR01464. This project has received funding from the European Union's Horizon Europe – the Framework Programme for Research and Innovation (2021-2027) under grant agreement No 101120706.

References

[1] Alzheimer's Association, Alzheimer's Disease Facts and Figures, (2024)
[2] Arslan, B., Zetterberg, H., & Ashton, N. J. Clinical Chemistry & Lab. Medicine, 62(6), 1063-1069, (2024)
[3] Calucho, E., Álvarez-Diduk, R., Piper, A., Rossetti, M., Nevanen, T. K., & Merkoçi, A., Biosensors and Bioelectronics, 258, 116315 (2024)