NANOCHANNELS IN BIOSENSING: A JOURNEY FROM STOCHASTIC SENSING TO DIAGNOSTIC APPLICATIONS

Alfredo de la Escosura-Muñiz[1,2]
[1]NanoBioAnalysis Group-Department of Physical and Analytical Chemistry, University of Oviedo, Spain
[2]Biotechnology Institute of Asturias, University of Oviedo, Spain

alfredo.escosura@uniovi.es

The stochastic sensing based on biomimetic single nanopores is considered as one of the more relevant breakthroughs in bioanalysis, being the DNA sequencing tool an outstanding milestone in modern research [1,2]. Inspired by it, the use of solid-state nanoporous membranes has paved the way to novel and versatile biosensing systems ranging from electrical to optical detection devices, bringing new advantages for biosensor development and application. The great potential of these systems for electrochemical clinical diagnostics deserves a special focus [3].

In this context, the purpose of this talk is to give a journey from the research in this field over the last two decades, from the basis of the stochastic sensing to the recent trends in the use of nanoporous membranes for biosensing applications. An overview of the applications for DNA sequencing and the detection of proteins, viruses and other analytes will be given. Special focus will be put in recent approaches for the *in-situ* monitoring of biomarkers for chronic wound infection diagnosis [4-7] and for the screening of antibiotics [4,8] a hot topic for facing antimicrobial resistance (AMR).

References

[1] A. de la Escosura-Muñiz, A. Merkoçi, ACS Nano 6(9) (2012) 7556.
[2] A. de la Escosura-Muñiz, A. Merkoçi, TrAC - Trends Anal. Chem. 79 (2016) 134.
[3] D. Valero-Calvo, A. de la Escosura-Muñiz, TrAC - Trends Anal. Chem. 172 (2024) 117568.
[4] A. de la Escosura-Muñiz, et al., ACS Appl. Mater. Interfaces, 11 (2019) 13140.
[5] A. Iglesias-Mayor, A. de la Escosura-Muñiz, et al., Biosens. Bioelectron. 209 (2022) 114243.
[6] D. Valero-Calvo, A. de la Escosura-Muñiz, et al., Microchim. Acta 190 (2023) 257.
[7] Toyos-Rodríguez A. Escosura-Muñiz et al., Front. Bioeng. Biotechnol. 12 (2024) 1310084.
[8] C. Toyos-Rodríguez, A. de la Escosura-Muñiz, et al., Anal. Bioanal. Chem. 415 (2023) 1107.

Acknowledgements. The financial support of Grants MCINN-24-PID2023–149004OB-I00, RED2022-134120-T and RED2024-153970-T funded by MCIN/AEI/ 10.13039/ 501100011033 and by "ERDF A way of making Europe", and of Grant SEK-25-GRU-GIC-24–071 funded by the Asturias Regional Government, is gratefully acknowledged.

Figures

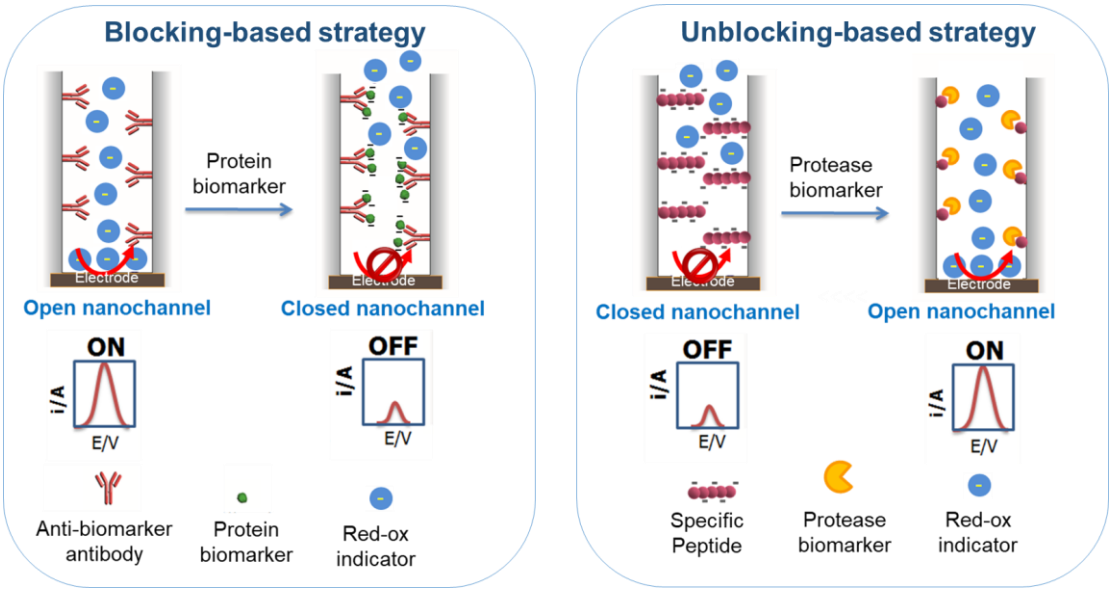

Figure 1. Scheme of the biosensing strategies followed for the detection of biomarkers using nanochannels.