Biomedical diagnosis with electrochemical sensors

Dr. Mònica Mir[1,3], Dr. Islam Bogachan Tahirbegi[1,2], Dr. Rosa Letizia Zaffino[1,2], Wilmer Alfonso Pardo[1,2], Prof. Josep Samitier[1,2,3]

[1] Nanobioengineering Group, Institute for Bioengineering of Catalonia (IBEC), Baldiri Reixac 10-12, Barcelona, Spain
[2] Department of Electronics, University of Barcelona, Martí I Franques 1, Barcelona, Spain
[3] Networking Research Center on Bioengineering, Biomaterials and nanomedicine (CIBER-bbn), Barcelona, Spain

mmir@ibecbarcelona.eu

Abstract

Sensors based on electrochemical detection methods represent the most promising platform to achieve inexpensive diagnostic devices. Electrochemical detection gives directly electronic signal, thus it does not need costly signal transduction equipment and it is easy to miniaturise[1], reducing the device size and volume of the sample and reagents, besides of bringing fast, sensitive and robust response. Such devices find applications in diagnostics, environmental analysis, food technology, forensics, pharmacology, and industrial processing[2]. For this application the majority of sensors are based on bioreceptors (antibodies, DNA, aptamers, enzymes) and in the case of ionic sensing, highly required in environment and medical monitoring, chemical receptors are used.

In this direction an all solid state ion selective sensor for pH and potassium detection was developed in our lab for ischemia sensing. This array was designed for being integrated in a set of bio-robotic endoscopic device for scarless monitoring of these analytes on the stomach tissue. This detection will permit to follow anastomosis failure during morbid obesity in laparoscopic surgery. This sensor was tested in vivo (Figure 1), showing good performance from both sensors[3].

Besides ionophores, DNA molecules are the biorecepetors mostly used in medical diagnosis But this diagnosis is linked to the need of a previous step to amplified and label the DNA with Polymerase Chain Reaction (PCR), which require costly equipment's and trained personnel. In a bid to overcome this limitation our laboratory is focused in two strategies; one is based on the integration of a PCR and an electrochemical array in a low cost an easy to use lab on a chip cartridge and the second strategy is based on a label free a highly sensitive nanosensors platform that do not required the PCR step[4].

References

[1] Schena, M. Bioessays, **18** (1996)427–31

[2] Asef Iqbal M., Gupta S.G., Hussaini S.S. Advances in Bioresearch, **3** (2012) 158 – 163.

[3] Tahirbegi I.S., Mir M., Samitier J., Biosensors & Bioelectronics, **40** (2013) 323–328

[4] Zaffino R.L., Mir M., Samitier J., Nanotechnology, in press

Figures

Figure 1. Ion selective sensor array for ischemia detection from an overture of the stomach