1. Biosensors and modified electrodes

Several definitions have been proposed to define biosensors. The definition given by IUPAC is that a biosensors is a device that uses specific biochemical reactions mediated by isolated enzymes, immunosystems, tissues, organelles or whole cells to detect chemical compounds usually by electrical, thermal or optical signals. A. Turner, the editor-in-chief of the «*Biosensors and Bioelectronics*» journal, a biosensor is "a compact analytical device incorporating a biological or biologically-derived sensing element either integrated within or intimately associated with a physicochemical transducer. The usual aim of a biosensor is to produce either discrete or continuous digital electronic signals which are proportional to a single analyte or a related group of analytes".

In 1962, Clark and Lyons managed to monitor glucose concentration in blood samples, using an enzyme-coated oxygen electrode. This was the first example of biosensor and since then, an ever-expanding field has arisen. Especially since the end of the nineties, with the introduction of portable, biosensor-based systems that can run electrolytes, blood gases, haemoglobin, glucose, calcium, urea, and other critical analytes on whole blood. This development is due to the fact that biosensors are at the interface between three major scientific domains: biology, chemistry and physics, so that any advances in one of these fields lead to further researches. Furthermore, various field of applications can be distinguished, the most important one being the medical domain. A study published in 2010 reveals that benefits generated by biosensors in general were about $6.72 billion and are expected to grow up to $14.42 billion in 2016. Industry experts expect that, early in the 21st century, biosensors will also be available for immunoassays and genetic screening. Current financial pressures demand on medical laboratory, on the one hand, very sophisticated and sensitive assays that are, on the other hand, fast, simple, and inexpensive. The effect of this is to join clinical testing with the medical therapeutic team outside the lab to provide cost-effective, proactive patient status information.

Among numerous analytes that can be targeted by point-of-care diagnostic ("outside the lab" or "at the bedside of the patient"), one find DNA (e.g. for virus targeting) or, most often, antigens that can be probed by selected antibodies using enzyme-liked immunosorbent assays (ELISA) or antibody displacement assays. Currently used detection-based tests such as solid-phase enzyme-immunoassay and fluoro-immunoassay are reliable and sensitive ; however, for modern use, the screening of a large number of samples with high-throughput needs to be implemented, e.g. for emergency diagnostics. Currently, commercially available strip tests, lateral flow devices for instance, involve fully passive systems with no quantitative analysis, no data storage, no possibility of data transmission to/from a remote location. It is now received that the technology that is needed must be based on active biosensor devices.