LABEL-FREE ELECTROCHEMICAL SENSING OF PROTEIN BIOMARKERS

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Methods for identifying protein biomarkers have the potential to significantly benefit biological applications and individual health. Numerous analytical techniques using carbon-based electrodes were described in our previous study [1-4].

Recently, electrochemical capacitance spectroscopy has arisen as an impedance-derived methodology which employs surface-confined redox-transducers, circumventing issues associated with the use of solution-phase redox-probes.

In the first work, we extend this scope by using phytic acid-doped polyaniline as a new redox-charging polymer support for sensitive reagentless C-reactive protein assays in blood [1]. The sensory interface is electropolymerized, allowing easy control of surface coverage and redox (capacitive) characteristics, which regulate test selectivity, fouling, and sensitivity. Also, we showed that an impedance-derived capacitance approach can resolve the resonant conductance properties of an electrode-confined polymer film. This conductance is then regulated by the capture of specific targets, for e.g. C-reactive protein, once the film is decorated with receptors [4].

In the second work, we describe a new redox capacitive biosensor based on a PANI polymer doped with phytic acid. This redox active support exhibited excellent baseline stability (2% drift over 7 h after initial stabilization for 30 min) and demonstrated a high resistance to nonspecific protein adsorption in the absence of additional antifouling components. The redox charging characteristics (scale and time frame) are changeable through the film thickness, allowing for fine-tuning of the interface's sensitivity. The following ease with which a large antibody load may be integrated results in interfaces with excellent target specificity. At ideal redox charging: receptor ratios, it is feasible to detect the cardiac biomarker CRP over its full clinically relevant range and down to 0.5 μg/mL. Notably, we believe that the electropolymerization assembly may be applied to any conductive surface and any biomarker of interest. The findings of the experiments will be discussed in more detail.

Acknowledgements: Dr Ausra Baradoke is grateful to Marius Jason Jakulis (MJJ) foundation for Scientists with International experience to come back to Lithuania.

References

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