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Sensors for biosensors: Efficient strategies towards successful screening and commercialization

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More than 50 years of the biosensors research have been mainly focused on the biosensor design optimization towards highly accurate and non-invasive measurements. In the last two decades, the nanotechnology-based materials recommended themselves as very effective transducers in various biosensing applications. Moreover, biosensors incorporating nano-based structures showed not only the enhanced mechanical, electrochemical, etc. properties in comparison to other materials, but also demonstrated a great potential towards rapid, high throughput, and cost effective single molecule detection. Nevertheless, the development of robust sensing technologies for continuous monitoring still remains a challenge either in clinical diagnostics or for other biotech applications. The main reason behind such failure is the lack of understanding and thorough analysis of the biosensor performance that results in unguaranteed biosensor stability and reproducibility and what is the most important, time and resource consuming “concept-to-market” development process. However, the significant progress and integration of such technologies in the industry can be obtained if the helpful tools underlying the fundamental principles behind the transduction and biorecognition mechanisms are developed. Herein, we present a novel strategy towards robust biosensor design optimization based on combining the results of multi-analytical studies together with the predictions of mathematical models. The presented tandem monitoring approach allows to identify and build-up the correlations between the critical operation conditions and system parameters affecting the overall biosensor response, its sensitivity and lifetime. The presented approach was fully validated through the number of electrochemical, chemical and morphological studies. Furthermore, the current challenges, limitations and further perspectives for further commercialization of nanobiosensor in industrial biotechnology will be discussed.

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