A Biosensor for the personalized health care for diabetes.

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Amino acids are building blocks of biological molecules, and they play a crucial role in cellular metabolism and neurological mechanisms. Dysregulation of these metabolic processes is linked to chronic diseases, such as diabetes[1]. Metabolic studies have therefore identified glycine and branched-chain amino acids (Leucine, Isoleucine, Valine) as potential biomarkers for the early detection of T1D. To diagnose and treat this debilitating disease, we have engineered genetically encodable glycine and Liv-K biosensors. It is based on periplasmic binding proteins, which undergo conformational changes upon ligand binding. Previously, this property was harnessed to create FRET sensors through fluorescent protein fusions to this binding protein core[2]. In this work, we have functionalized screen-printed electrodes with these FRET sensors, using their spectral change to alter electrode surface upon addition of the target ligand. This was in turn monitored through cyclic and differential pulse voltammetry using a redox label (ferricyanide)[3], allowing for accurate and specific sensing of our targets in concentrations ranges of 0.1 to 10,000 µM for our GlyFS and 0.001 to 10,000 µM for our Liv-K sensor. Altogether, these biosensors form an essential step towards the application of electrochemical sensing to the monitoring of diseases, leading to new miniaturized sensors with high sensitivity and low-cost.

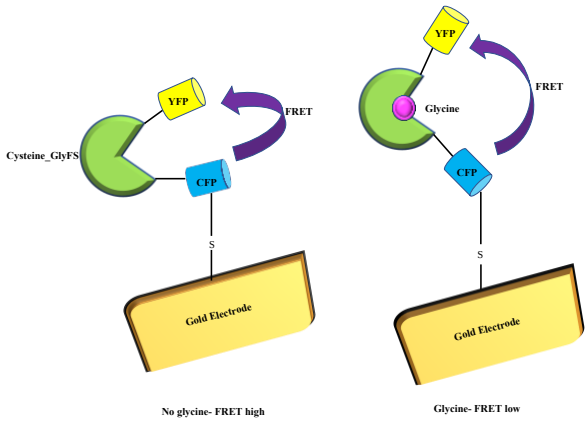

Figure 1: Characterization of a FRET-based cysteine_GlyFS biosensor. Schematic model of the developed biosensor. In the absence of ligand, binding core adopts a closed form upon glycine binding, leading to an open form.

References

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