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A Novel Photoelectrochemical Biosensor for Cystic Fibrosis Detection †

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Nucleic acids and corresponding mutations are crucial in the diagnosis of a broad range of genetic diseases such as cystic fibrosis [1]. This is the most common and fatal autosomal recessive genetic disease in EU countries and the USA [2].

Over the years, different electrochemical sensors have been developed for the detection of nucleic acids to meet the demand for point-of-care diagnostics. However, these technologies have different drawbacks such as: (i) low limit of detection (ii) need of a well-defined orientation of DNA strands on the electrode surface (iii) need of a trained person and iv) time-consuming sample preparation [3].

This work contributes to the diagnosis of cystic fibrosis via the development of a novel photoelectrochemical biosensor for the detection of its most common DNA mutation (i.e., ΔF508, accounting for approximately 70% of all mutations) in the gene *cystic fibrosis transmembrane conductance regulator*.

This groundbreaking platform exploits a sandwich assay combining (i) photosensitizers, that produce singlet oxygen ($^1O_2$), as a label in the detection strategy, (ii) a redox reporter (i.e., hydroquinone) and (iii) magnetic beads, used to attract the synthetic DNA sequences close to the electrode surface, enhancing the sensitivity [4]. Since the signal is only triggered by light, a main advantage of our sensor is the clear distinction between signal and background by turning on/off the light source.

Using this platform, we explore the effect of different buffers on the resulting photocurrent and we demonstrate the specific detection of the desired target (ΔF508) while avoiding unwanted interactions with random sequences.

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