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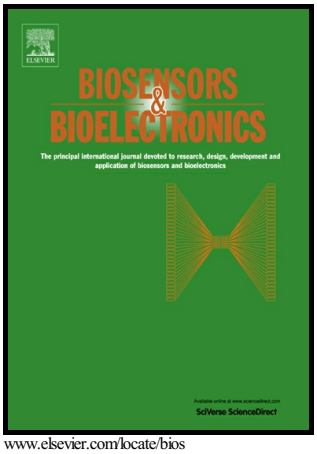

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Quantum Dot-based Electrochemical Biosensor for Stripping Voltammetric Detection of Telomerase at the Single-Cell Level

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Abstract

Human telomerase is responsible for the maintenance of chromosome end structures and is a valuable biomarker for malignant growth. However, the accurate measurement of telomerase activity at the single-cell level has remained a great challenge. Here we develop a simple quantum dot (QD)-based electrochemical biosensor for stripping voltammetric detection of telomerase activity at the single-cell level. We designed a thiol-modified capture DNA which may be immobilized on the gold electrode by the gold-sulfur bond. The presence of telomerase enables the addition of the telomere repeats of $(TTAGGG)_n$ to the 3' end of the primer, accompanied by the incorporation of abundant biotins in the extension product with the assistance of the biotin-tagged dATP. The subsequent hybridization of extension product with the capture DNA and the addition of streptavidin-coated QDs induce the assembly of large amounts of QDs onto the electrode via specific biotin-streptavidin binding. After the acidic dissolution of QDs, the released Cd (II) can be simply quantified by anodic stripping voltammetry (ASV). Due to the introduction of large amounts of QDs by telomerase-induced primer extension reaction and the synergistic signal amplification induced by the release of Cd (II) from the QDs, this biosensor can detect telomerase activity at the single-cell level without the involvement of any thermal cycling and extra enzymes for signal amplification. Moreover, this assay exhibits

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