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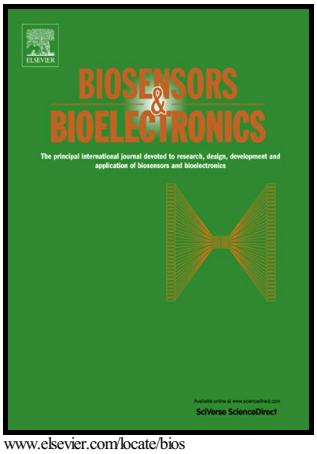

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Broccoli-shaped Biosensor Hierarchy for Electrochemical Screening of Noradrenaline in Living Cells

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Abstract

Monitoring and determination of ultra-trace concentrations of monoamine neurotransmitter such as noradrenaline (NA) in living cells with simple, sensitive and selective assays are significantly interesting. We design NA-electrode sensing system based on C-, N-doped NiO broccoli-like hierarchy (CNNB). The spherical broccoli-head umbrella architectures associated with nano-tubular arrangements enabled to tailor NA biosensor design. The homogenous doping and anisotropic dispersion of CN nanospheres along the entire NB head nanotubes lead to creating of abundant electroactive sites in the interior tubular vessels and outer surfaces for ultrasensitive detection of NA in living cells such as PC12. The CNNB biosensor electrodes showed efficient electrocatalytic activity, enhanced kinetics for electrooxidation of NA, and fast electron-transfer between electrode–electrolyte interface surfaces, enabling synergistic enhancement in sensitivity, and selectivity at a low-detectable concentration of ~ 6 nM and reproducibility of broccoli-shaped NA-electrodes. The integrated CNNB biosensor electrodes showed evidence of monitoring and screening of NA released from PC12 cells under K^+ ion-extracellular stimulation process. The unique features of CNNB in terms of NA-selectivity among multi-competitive components, long-term stability during the detection of NA may open their practical, in-vitro application for extracellular monoamine neurotransmitters detection in living cells.

Keywords: Noradrenaline; Biosensors; Broccoli-shaped hierarchy; Electrochemical screening; living cells.

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