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Electrochemical biosensors for the ultrasensitive detection of microRNA

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MicroRNAs are a class of non-protein-coding small RNA molecules with 17-25 nucleotides. The expression of microRNAs is related to some biological processes including cell differentiation, apoptosis, proliferation, and immunological response. Recently, microRNAs have emerged as new candidate diagnostic and prognostic biomarkers for the detection of a wide variety of cancers such as hematopoietic cancers, breast, lung, and colon cancers. Due to short sequences and high sequence homology among family members, the quantitative microRNAs analysis is still a challenge. Electrochemical biosensors have attracted increasing attention because of its low cost, convenient operation, rapid detection, and good sensitivity. To further improve electrochemical signals, labeling methods integrated with signal amplification strategies such as nanoparticles-based amplification, enzymatic signal amplification, and rolling circle amplification etc. have been developed. In our researches, a novel electrochemical biosensor with triple signal amplification for the ultrasensitive detection of microRNA was developed based on phosphatase, redox-cycling amplification, bimetallic metal alloy supported graphene functionalized gold electrode, and two stem-loop structured DNA were used as target capturers. In addition, another ultrasensitive electrochemical genosensor based on two DNA as the target capturers and metal functionalized nanoparticles as a label is employed for the detection of microRNA at an attomole level. These proposed biosensors are sufficiently selective to discriminate the target microRNA from homologous microRNAs and attractive candidates for the development of accurate, selective, and ultrasensitive methods for microRNA expression profiling and clinical diagnostics.

Biography

Jun-Jie Zhu has completed his PhD in Nanjing University in 1993 and Postdoctoral studies in Bar-Ilan University, Israel. Since 2001, he has been a Full Professor in Nanjing University. Now, he served as a vice dean of Nanjing University Graduate School. His main research area involves nano-bioanalytical chemistry. He has published some papers in reputed journals such as JACS, Nano Lett. Anal Chem.et al. and has been serving as some Journal editorial board member.

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