

细胞阻抗传感器优化设计及其在毒素监测中的应用

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摘要：

本文介绍了我们设计的微结构细胞阻抗传感器，采用微电子加工技术在硅基底上制作了以叉指结构金电极为工作电极的传感芯片，将脐静脉内皮细胞系ECV304培养和固定在器件上，进行连续的细胞阻抗监测。本文研究了细胞阻抗随频率和时间改变的定量关系。结合细胞贴附前后的叉指电极等效电路模型，进一步分析了细胞贴附对阻抗变化的影响，给出了细胞阻抗传感器的优化设计方法。最后，采用该细胞传感器对有毒毒素进行了实验分析，分析了毒素对哺乳动物血管的毒性作用，初步的实验结果表明，该本文设计的细胞阻抗传感器具有实时无标记快速检测的优点，可应用于毒素监测等生物医学领域。

关键词：细胞传感器；叉指电极频率特性；细胞阻抗传感；细胞毒素检测

Optimization Design of Electrical Cell-substrate Impedance Sensor and Application to Toxicant Monitoring

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Abstract:

A continuous monitoring technique based on electrical cell-substrate impedance sensor was demonstrated for measuring physiological changes of endothelial cell line ECV304. The response mainly reflected the resistant changes as a result of cell adhesion and spreading. Cell impedance as a frequency and time function was analyzed based on the interdigitated electrode model to extract some guidelines for optimization design of impedance sensor. Finally, preliminary experiments were carried out to analyze cytotoxicity of toxicant on the vessel cells by monitoring the impedance time functions. The results demonstrated this sensor to be a rapid, online, label-free approach on monitoring toxicant.

Keywords: Cell-based biosensor; Frequency Characterization of Interdigitated Electrodes; Electrical Cell Substrate Impedance Sensing; Toxicant Monitoring

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