Wearable, High Sensitivity Bio-Transistor for the Detection of Lactate in Sweat (Year II)

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The continuous monitoring of human physiological health without the presence of a doctor has been a recent subject of innovation. A popular method for detecting various factors involves analyzing bodily fluids, which offers valuable information through biomarkers and hormones linked to critical diseases. Among these, in-situ sweat analysis stands out for its non-invasive nature and ease of access, showing great promise in long-term health monitoring. Existing methods for sweat monitoring are often expensive and unable to cover the entire range of the biomarker of interest, and have limited detection speeds. Lactate, a critical biomarker present in sweat, remains a focus of ongoing academic research for its wide applications in sports medicine and surgery. This project demonstrates a rapid, highly sensitive bio-transistor capable of continuously monitoring lactate concentrations in human sweat across the full range of 0.1 to 30 mM. To achieve the above goal, a novel biosensor based on Organic Electrochemical Transistor (OECT) is developed with high capacitance in both gate and channel, a substantial improvement over conventional designs. This approach employs catalytic Lactate Oxidase and Prussian Blue reactions to efficiently convert lactate into detectable ions, resulting in a significant change in the drain current of the OECT. The results demonstrated that the OECT, on average, could effectively detect 30mM of Lactate under 120 seconds, marking a notable advancement over state-of-the art sensors. The next major step is to create a bluetooth app to provide patients with a real-time analysis of their physiological health, powered by AI custom analysis.

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