# Development of a Portable Enzyme-Based Sensor for Real-Time Monitoring of Estradiol Levels

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Estradiol plays a crucial role in various physiological processes, including reproductive health and bone density regulation. Currently, the most common methods for detecting estradiol—liquid chromatography-tandem mass spectrometry (LC-MS/MS) and surface-enhanced Raman spectroscopy (SERS) — are both highly sensitive and accurate. However, these techniques are expensive and require sophisticated instrumentation, highlighting the need for a portable and cost-effective device to monitor estradiol levels in the human body.

In response to this need, the present study introduces an innovative enzyme sensor designed for easy and affordable estradiol detection. As we reported previously [1-2], the sensor features a carbon paper electrode electroplated with lysine, creating amino groups on its surface and providing a cost-effective, replaceable platform for regular monitoring. Glutaraldehyde is then used as a crosslinking agent to bind laccase enzyme biocatalysts to these amino groups. Under conditions where thionine acts as an electron mediator (Fig.1), the sensor demonstrates a strong linear relationship between current and estradiol concentration. Notably, the sensor performs well even at very low estradiol concentrations, making it suitable for continuous, real-time monitoring of estradiol levels. By offering an efficient, cost-effective, and practical tool for estradiol detection, this study addresses a critical gap in the market. The proposed device has the potential to significantly advance both clinical diagnostics and personal health management, contributing to improved hormone level monitoring in various healthcare settings.

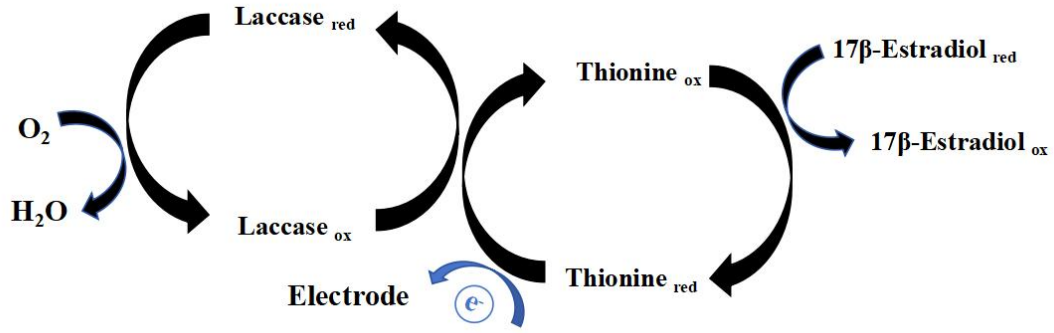


**Fig. 1. The electrocatalytic mechanism of enzyme biosensor.**

## Reference

[1] T. Miyake, et al. Advanced Materials Technologies, 8, 2201704, 2023.
[2] T. Miyake, et al. Biosensors and Bioelectronics, 179, 113107, 2021.