Enhanced Glucose Sensing through Tailored Enzyme-Inspired Substrate Channels on Electrode Surface

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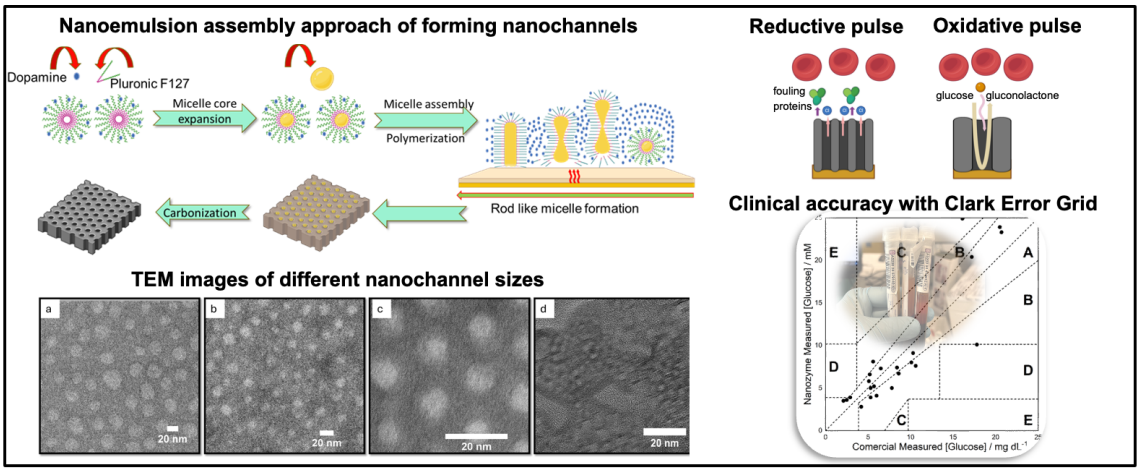
The design of nanozymes that mimic the activity and selectivity of natural enzymes is a promising strategy for sensing applications. However, achieving high selectivity in complex biological media like blood remains a challenge. We present a carbon nanochannel-based platform for non-enzymatic glucose sensing in whole blood, leveraging nanoconfinement for enhanced selectivity and sensitivity. By precisely tuning channel geometry, we optimized glucose detection efficiency. Our two-step pulsed method removes interferences and facilitates glucose oxidation within confined nanochannels. Increasing channel length enhances sensitivity up to an optimal threshold, while diameter variations have minimal impact. Clinical accuracy was validated using the Clark Error Grid method, the sensor shows high sensitivity in hypoglycemic ranges, crucial for neonatal diabetes management.[1] Unlike enzymatic sensors prone to biofouling and degradation, our nanozyme-based sensor offers superior long-term stability over 18 months, making it a sustainable alternative for continuous glucose monitoring. This innovative sensor is on its way for the commercialization to provide affordable and reliable glucose monitoring for clinical and personal healthcare.



Reference

[1]Dissanayake, M., Somerville, S. V., Soda, Y., Yao, Y., Duong, H. T. K., Tilley, R. D., & Gooding, J. J. (2025). An array of glucose Nanozymes that can selectively detect glucose in whole blood. *ACS Sensors*, *10*(1), 545–552. https://doi.org/10.1021/acssensors.4c03106