Biosensors Based on Infection Mechanism Mimicry at The Core of Diagnostic Systems

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Abstract
Biosensors possess inherent characteristics—such as practicality, robustness, and cost-effectiveness—that make them highly suitable for conversion into diagnostic tests including point of care (PoC) systems. PoC systems can be defined as on-site diagnostic tests carried out at the patient bed-site using mobile devices like hand-held devices or a cart. These tests provide faster diagnosis by avoiding the need for laborious procedures and trained personnel.
The COVID-19 pandemic, caused by the SARS-CoV-2 virus, underscored the urgent global need for rapid, user-friendly, economical, and practical testing solutions. In this context, biosensors have gained increased attention as they can serve as the core technology behind such diagnostic systems [1]. Conventional biosensors typically rely on antigen–antibody, enzyme, microorganisms, nucleic acids or aptamer-based recognition mechanisms. However, alternative approaches have also emerged, including biosensors that utilize glycan-based recognition elements. Our research group has focused on this latter category, developing biosensors that mimic the infection mechanisms of viruses. This biomimetic strategy offers a significant advantage: the ability to detect multiple virus variants without the need to frequently redesign key recognition components, as is often required with other conventional biosensor systems [1]. Building upon this concept, we have successfully developed both electrochemical and spectroscopic biosensors for infectious disease diagnostics [1, 2]. In parallel, the incorporation of nanomaterials into diagnostic biosensor platforms has introduced several performance-enhancing benefits. These include a high surface-to-volume ratio—allowing for efficient functionalization with bioactive molecules—as well as excellent electrochemical capacity, conductivity, tunable optical properties and biocompatibility [1]. In conclusion, the strategic integration of nanomaterials into biosensor platforms not only enhances their sensitivity and specificity but also broadens their application potential in diagnostic systems, making them increasingly viable as core components of next-generation diagnostic technologies

References

[1] Özyurt, V.H., Çitil, B.E., Anik, Ü ChemistrySelect 2024, 9, e202405064 (1 of 9)
[2] Can, G., Perk B., Çitil B. E., Büyüksünetçi, Y. T.,Anık Ü et. al., Anal. Chem. 2024, 96, 8342−8348)

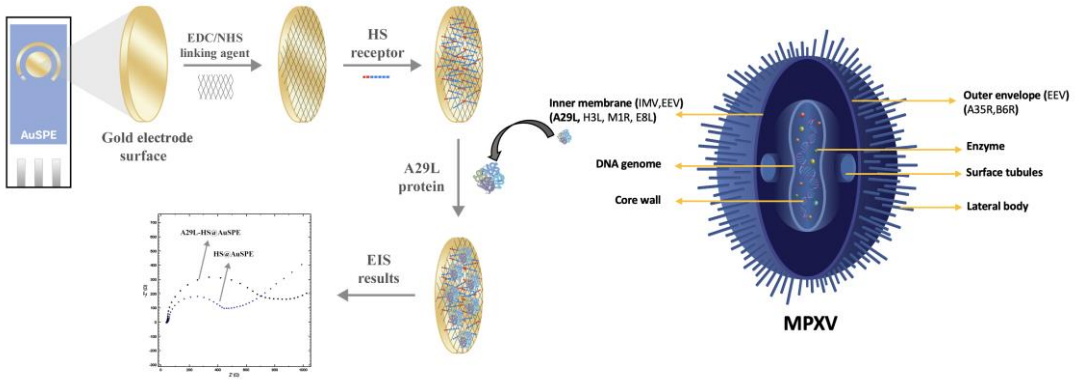

Figure 1 fabrication of MPXV immunosensor via virus infection mimicry [2]