A rapid and sensitive bioelectrical biosensor for the detection of the SARS-CoV-2 S1 spike protein based on membrane-engineered cells

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Abstract

As a result of the COVID-19 pandemic, novel diagnostic tools are needed to reliably monitor of infected individuals, particularly including asymptomatic patients and/or during the first days following of infection. Therefore, we developed a novel biosensor for the SARS-CoV-2 S1 spike protein antigen. The biosensor was based on measuring changes in the bioelectric responses of membrane-engineered mammalian Vero cells bearing the human chimeric spike S1 antibody, according to the principles of the Bioelectric Recognition Assay [1] and the technology of Molecular Identification through Membrane Engineering [2]. The biosensor was able to detect the viral antigen in three minutes without any prior sample processing and with a high specificity (pg/ng level) and selectivity against other virus-associated proteins. In addition, we have coupled our approach with a Point-of-Care recording device which can be operated by lay users with minimum training and operated via a smartphone.

REFERENCES

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[2] Kokla A, Blouchos P., Livaniou E., Zikos C., Kakabakos S.E., Petrou P.S., Kintzios, S., Visualization of the membrane-engineering concept: evidence for the specific orientation of electroinserted antibodies and selective binding of target analytes, Journal of Molecular Recognition 26, (2013), 627-232.

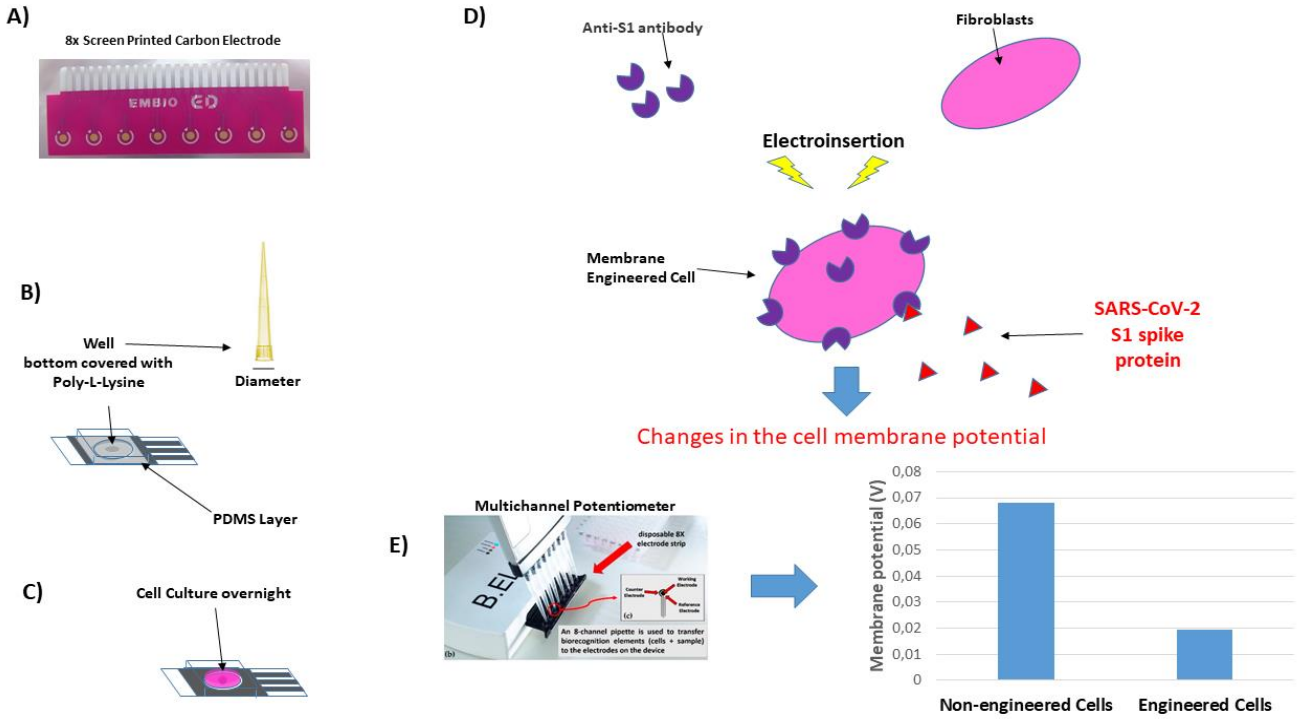

Figure 1: Graphical abstract presentation of the process for developing a Bioelectic Recognition Assay for the detection of the SARS-CoV-2 S1 spike protein antigen using membrane-engineered cells as biorecognition elements.