A Bioelectronic Platform for Rapid Detection of COVID-19 and More

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Melbourne Centre for Nanofabrication Boardroom
151 Wellington Road, Clayton, 3168
Zoom link: click here
Meeting ID: 868 4122 8148 and passcode: 780010

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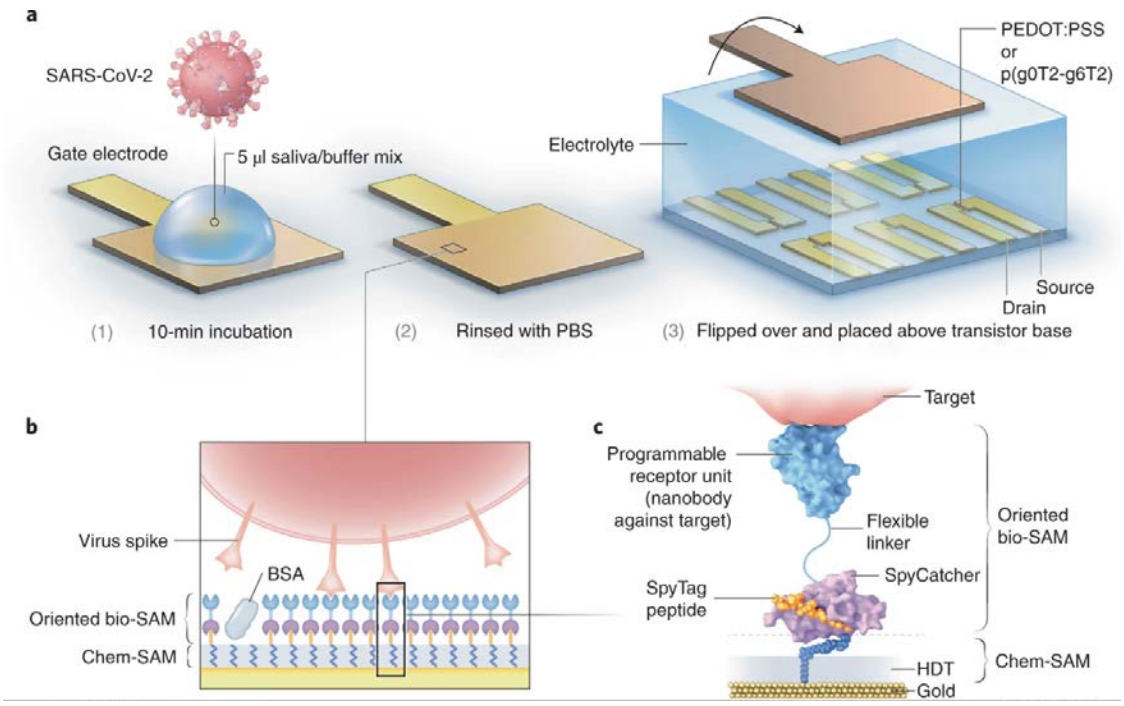
Abstract:
COVID-19 pandemic has highlighted the need for rapid and sensitive protein detection and quantification in simple and robust formats for widespread point-of-care applications. We here introduce a modular nanobody-functionalized organic electrochemical transistors (OECT) architecture that enables rapid quantification of single-molecule-to-nanomolar levels of specific antigens in complex bodily fluids. The sensors combine a new solution-processable organic semiconductor material in the transistor channel and the high-density and orientation-controlled bioconjugation of nanobody–SpyCatcher fusion proteins on disposable gate electrodes. They provide results after 10-min of exposure to 5 μL of unprocessed samples, maintain high specificity and single-molecule sensitivity in human saliva and serum, and can be reprogrammed to detect any protein antigen for which nanobodies exist. We demonstrate the use of this highly modular platform to detect green fluorescent protein (GFP), SARS-CoV-2 and MERS-CoV spike proteins, and for the COVID-19 screening of unprocessed clinical nasopharyngeal swab and saliva samples with a wide range of viral loads. The speed, performance and versatility of our nanobody-functionalized OECT, and its compatibility with many sample types, suggest that this biosensor technology can complement or replace a wide range of clinical and non-clinical diagnostic assays for serious diseases including but not limited to COVID-19.



References

[1] **Guo, Keying**, et al. Rapid single-molecule detection of COVID-19 and MERS antigens via nanobody-functionalized organic electrochemical transistors. *Nature Biomedical Engineering*, 5, 666–677 (2021)

Keying's Short Biography

Dr. Keying GUO is an Associate Professor in the program of Biotechnology and Food Engineering at Guangdong Technion - Israel Institute of Technology (GTIIT) since March 2023. Keying is also affiliated with the Faculty of Biotechnology and Food Engineering at Technion - Israel Institute of Technology. Keying graduated with Bachelor and Master degree in Material Science and Engineering from 2008 to 2015 in China. In 2019, he earned his PhD in Drug Delivery Science under Professor Nicolas H. Voelcker's supervision from Monash Institute of Pharmaceutical Sciences (MIPS) at Monash University. During his PhD study, he was awarded three research travel grants to support his research training and international research stays in Professor Michael J. Sailor's lab at UCSD (US), and University of Bayreuth (Germany). After his PhD at Monash University, Keying completed a short postdoctoral training at MIPS, working on biosensors to detect preeclampsia exosome biomarkers. From 2019 to 2023, Keying spent 3 years and 6 months as a postdoctoral fellow in Professor Sahika Inal's lab at King Abdullah University of Science and Technology (KAUST) in Saudi Arabia. At KAUST Keying had developed an interdisciplinary approach to fit-for-purpose diagnostic tools for detection of diseases' biomarkers using organic electrochemical transistors (OECTs). From June 2023, Keying became an Adjunct Associate Professor (Research) at MIPS, Monash University.

WeChat

Lab Website

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