Antibody detection of SARS-CoV-2 spike protein by an integrated plasmonic microfluidic chip

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The worldwide outbreak of severe acute respiratory syndrome related coronavirus 2 (SARS-CoV-2) has led to active research in related diagnostics and medical treatments. While quantitative reverse transcription polymerase chain reaction (qRT--PCR) is currently the best methodology to detect the virus at the early stage of the infection, serological tests for specific antiviral antibodies are complementary as they identify false negative qRT--PCR responses, track how effectively the patient's immune system is fighting the infection, and are potentially helpful for plasma transfusion therapies. Motivated by finding a reliable and cost-effective alternative to existing serological methodologies, we report the development of an opto-microfluidic platform to quantify the concentration of anti-SARS-CoV-2 spike protein antibodies in diluted human plasma by capturing the wavelength shift of the localized surface plasmon resonance (LSPR) peak of gold nanostructures in the microfluidic device upon binding interactions with SARS-CoV-2 spike protein within 30 minutes, without labelling agents. This label-free microfluidic platform achieves a limit of detection of ~0.5 pM, falling under the clinical relevant concentration range. We demonstrate that our opto-microfluidic platform offers a promising point-of-care testing tool to complement standard serological assays and make SARS-CoV-2 quantitative diagnostics easier, cheaper, and faster [1].

REFERENCES

[1] Riccardo Funari, Kang-Yu Chu, Amy Q. Shen, Biosensors and Bioelectronics, 169, (2020). 112578.

FIGURES

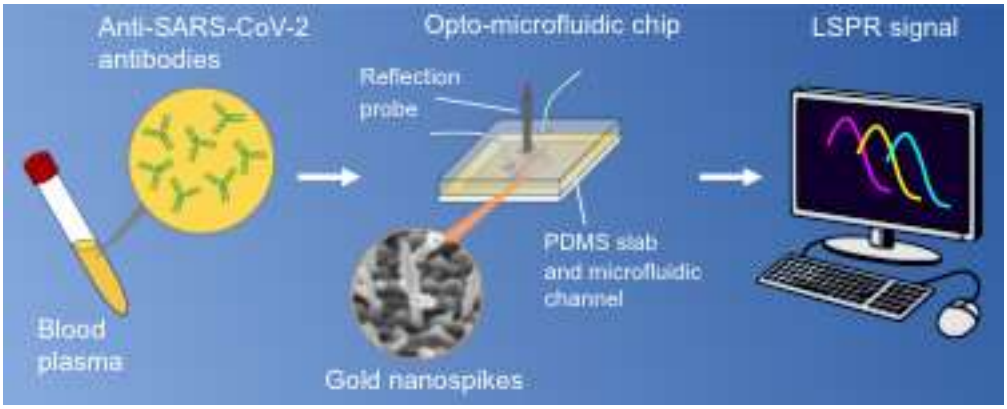

Figure 1: Experimental schematic of the optomicrofluidic chip for COVID-19 antibody detection: plasmonic substrate containing gold nanospikes is integrated into a PDMS device with fiber optic probes. The samples are delivered to the microfluidic platform by a syringe pump. The reflective fiber optic probe delivers the light provided by the light source to excite the gold nanospikes. The same probe collects the reflected light to the detector.