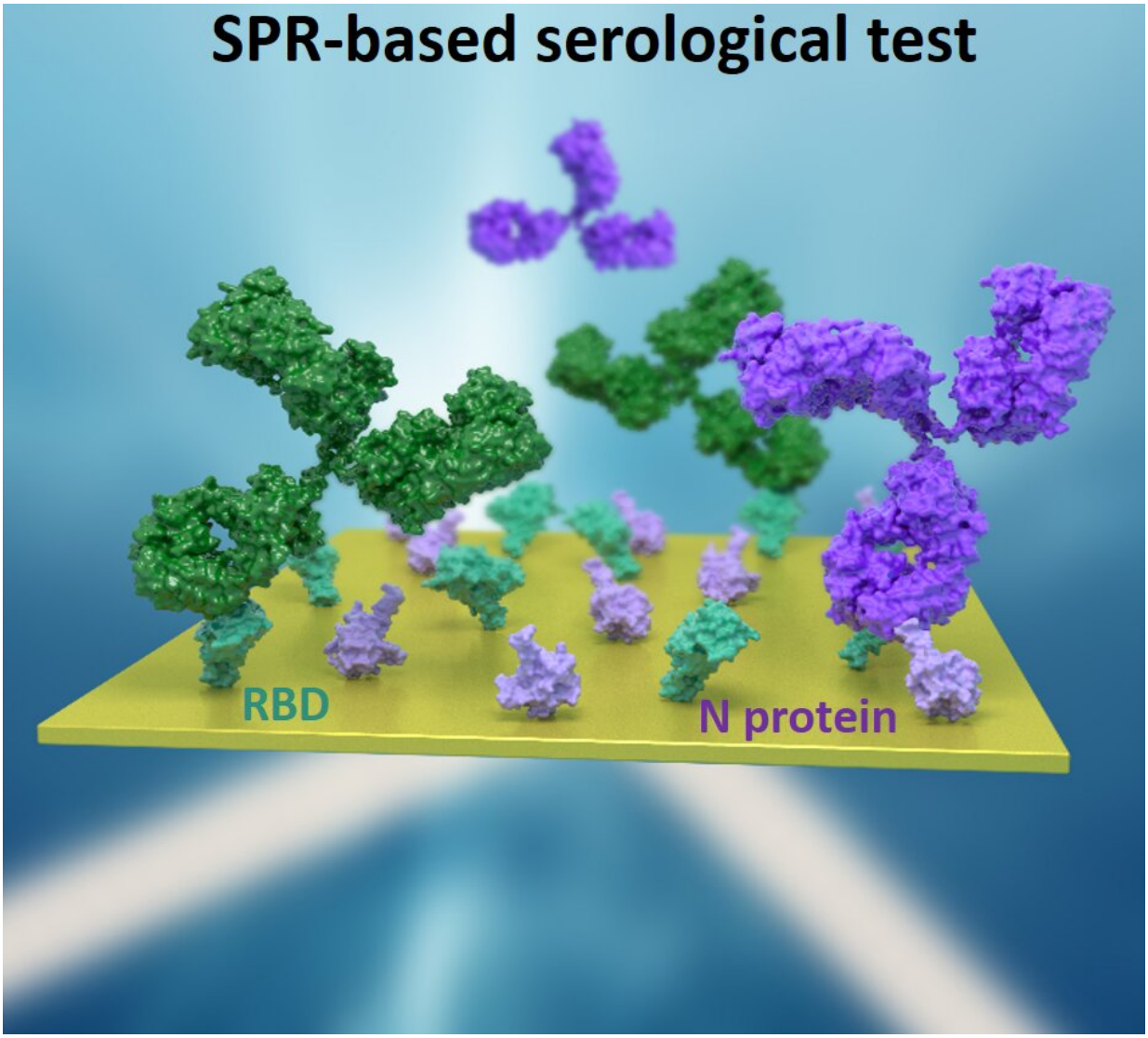
New optical biosensor enables rapid and quantitative serological testing of COVID-19

March 2 2022



SPR-based serological test. Credit: ICN2

Serological tests play an important role in the surveillance and management of epidemics or pandemics, as well as in acquired immunity studies. Currently, COVID-19 serology is performed by well-established immunoassay techniques, which provide high sensitivities, but require specialized laboratories with trained personnel and processing times of 3 to 48 hours. A much faster and easier method is the lateral flow assay—such as the rapid diagnostic tests sold in pharmacies. However, the latter are not fully reliable, as they exhibit only moderate sensitivity and specificity.

A team of researchers led by Prof. Laura M. Lechuga, CSIC Research Professor and head of the NanoBiosensors and Bioanalytical Applications Group at the Catalan Institute of Nanoscience and Nanotechnology (ICN2), at the Universitat Autònoma de Barcelona (UAB) campus, has developed and extensively validated a novel serological nano-biosensor that provides a rapid (less than 15 minutes) identification and quantification of SARS-COV-2 antibodies in blood serum, without the need for sample pre-treatment and lengthy processing. It employs an optical sensing device based on a plasmonic technique that Prof. Lechuga's group has been consolidating for years and has implemented for the diagnostics of diverse diseases and conditions—such as detection of cancer biomarkers, gluten ingestion or antibiotic allergy.

Extensive testing on clinical samples, provided by the Vall d'Hebron University Hospital and the Hospital Clínic of Barcelona–IDIBAPS during the first months of COVID-19 pandemic, was performed to prove the efficacy and reliability of this biosensor technology. In particular, 120 samples of serum were used, of which 100 from confirmed COVID-19 positive patients and 20 negative ones (collected prior to the outbreak of the pandemic). Comparative analyses with standard techniques and commercial lateral flow assays showed that this plasmonic biosensor technology outperforms well-established diagnostic

methods, providing excellent sensitivity (99%) and specificity (100%).

Such remarkable accuracy and the short operation times (the result is available in less than 15 minutes) make of this new biosensor an outstanding tool for rapid and reliable serological tests. Fast and quantitative serology is crucial for monitoring the evolution of the COVID-19 pandemic, managing patients' hospitalization and placement in intensive care units and assessing the immunological status of individuals during vaccination campaigns and in the presence of emerging variants of the virus.

Since the read-out device is compact and the procedure can be automatized, this technology has also potential for point-of-care applications and could be introduced in doctors' practices and pharmacies. In addition, the same technique can be employed for the detection of various substances in body fluids—such as gluten peptides, early cancer biomarkers, anticoagulant drugs, or antibiotic allergy antibodies—thus, for the diagnostics and monitoring of many diseases.

The readiness level of this technique is already very high and their developers are committed to achieve a fast technology transfer to industry, in order to introduce this new biosensor device both in the clinical environment and in decentralized settings. Watch this animation illustrating how a portable read-out device with disposal cartridges would work.

The results of this study, carried out in the framework of the EU funded project CoNVaT, have been published in *Analytical Chemistry*.

More information: Olalla Calvo-Lozano et al, Label-Free Plasmonic Biosensor for Rapid, Quantitative, and Highly Sensitive COVID-19 Serology: Implementation and Clinical Validation, *Analytical Chemistry* (2021). DOI: 10.1021/acs.analchem.1c03850

Provided by Autonomous University of Barcelona

Citation: New optical biosensor enables rapid and quantitative serological testing of COVID-19 (2022, March 2) retrieved 16 August 2024 from https://phys.org/news/2022-03-optical-biosensor-enables-rapid-quantitative.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.