Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Editorial on COVID-19 biosensing technologies- 2d Edition

After the 1st Edition, this 2d one on COVID-19 biosensing technologies offers to the Biosensors and Bioelectronics readers the recent efforts of the biosensors community about the development of advanced biosensors for COVID-19 related biomarkers and their applications in real clinical scenarios and other settings. This issue includes 19 contributions from authors from various laboratories around the world. The developed biosensors are interested in detecting the virus or related biomarkers in different physiological fluids and other samples, including virus presence in the air. The reported devices are based on various detection technologies ranging from optical to electrical ones and involve different platforms, nano/micromaterials and are offered (mostly) as fully integrated biosensing systems.

Hyun Lee et al. (Hyun Lee et al., 2022) investigated the detection of peptides derived from the receptor-binding domain (RBD) in SARS-CoV-2 and SARS-CoV using metamaterial-based sensing chips with a terahertz time-domain spectroscopy (THz-TDS) system. The developed metamaterial-based THz-TDS analytic tools may be useful for point-of-care and label-free diagnosis. A graphene-based Electrical-Electrochemical Vertical Device (EEVD) point-of-care biosensor for serologic COVID-19 diagnosis (IgG quantification) was developed by Mattioli et al. (2022) This EEVD device that takes advantage of graphene was applied in real human serum samples showing advantages in terms of the time of analyses (15 min) and a LOD of 1.0 pg mL-1 between others.

To overcome the drawbacks of gold-based lateral flow immunoassay (GLFIA) in terms of sensitivity and specificity(Jia et al., 2022) et al., developed a fluorescent LFIA based on signal amplification and dual-antigen sandwich structure. These LFIA devices were applied in more than 300 cases of COVID-19 negative and 97 cases of COVID-19 positive samples showing to be highly sensitive towards low concentrated SARS-CoV-2 antibody serums and highly specific towards serums from COVID-19 negative persons and patients infected by other viruses (as compared by both polymerase chain reaction (PCR) and chemiluminescence immunoassay (CLIA)).

A portable and low-cost electrochemical immunosensor for the rapid and efficient detection of SARS-CoV-2 serum antibodies was developed by Peng et al. (2022) This device was shown to be able to quantify immunoglobulin G (IgG) and immunoglobulin M (IgM) antibodies against the SARS-CoV-2 spike protein in human serum being an interesting alternative for both point-of-care diagnosis and population immunity screening.

Ju et al. (2022)reported rapid and accurate clinical testing for COVID-19 through a nicking and extension chain reaction system-based amplification (NESBA). They designed primers to identify SARS-CoV-2 viral RNA and ensured an enhanced amplification strategy that could detect SARS-CoV-2 genomic RNA (gRNA) down to 0.5 copies/μL (= 10 copies/reaction) for both envelope (E) and nucleocapsid (N) genes within 30 min under isothermal temperature (41 °C).

A simple virus detection assay with high sensitivity and specificity by using the localized surface plasmon resonance (LSPR) principle and the aggregation of antigen-coated gold nanoparticles (GNPs) to detect SARS-CoV-2 Nucleocapsid (N) proteins was introduced by Behrouzi et al. (Behrouzi and Lin, 2022)

An aptamer-based biosensor (using a screen-printed carbon electrode and impedance spectroscopy) targeting the receptor-binding domain (RBD) in the spike protein (S-protein) of the SARS-CoV-2 was developed by Abrego-Martinez et al. (Juan Carlos Abrego-Martinez et al., 2022) Searching for lower cost and more efficient devices, Zhang et al. (2021), developed a virus protein serum assay. The main protease of the virus was targeted by a short probe mimicking its substrate. The used electrochemical method successfully detected the virus marker protein in the serum of the infected patients.

A multiplex one-pot pre-coated interface proximity extension (OPIPE) assay for the simultaneous recognition of antibodies using a pre-coated antigen interface and a pair of anti-antibodies labeled with oligonucleotides was developed by Yan et al. (2021) The authors used some fluorescent probes and were able to co-detect SARS-CoV-2-specific antibodies and viral nucleic acids in a single bio-complex sample (including nucleocapsid protein-specific IgG and IgM, and some RNA fragments). Using another electrochemical method (voltammetry) and functionalised graphene oxide modified glassy carbon electrode, the analysis of SARS-CoV-2 spike protein was achieved. This method, developed by Liv et al. (2021), was compared with conventional techniques and reported to have the potential for diagnosing COVID-19 in real samples.

Daniels et al. (2021), reported an interesting electrochemical biosensor within a mask-based sampling device that collects exhaled breath condensate (EBC) and can detect COVID-19 virus. The efficiency was demonstrated in SARS-CoV-2 positive and negative patients. A colorimetric paper-based dot blot spike protein diagnostic assay for COVID-19 coupled with a smartphone was developed by Ghorbanizamani et al. (2021) The method showed high sensitivity (10 times better than gold nanoparticles), stability, fast turnaround, and reproducibility.

Considering that the accurate assay of cardiac troponin I (cTnI) is very important for acute myocardial infarction (AMI) and the fact that it also can be employed for screening seriously ill patients in COVID-19 pandemic, a ratiometric sensing strategy was proposed by Mi et al. (2021) It was based on either electrochemiluminescent (ECL) or electrochemical (EC) detection of proper compounds combined with specific interactions of an aptamer. The proposed biosensors showed good

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specificity, sensitivity, reproducibility and stability and were applied to determine cTnI in real samples with satisfactory results.

ElDin et al.(Norhan Badr et al., 2021), microfabricated potentiometric sensors using copper as the substrate modified with graphene nanocomposites and used these devices to evaluate the kinetics of MCH (methacholine) enzymatic degradation in real blood samples. This parameter was related to the disease state of COVID-19 pneumonia being interested in predicting the severity/prognosis of COVID-19.

Lee et al. (Hoon Lee et al., 2021) developed a rapid microfluidic serological assay consisting of a microfluidic chip and fluorescence reader. This device is useful for the rapid on-site detection and comprehensive understanding of the immune response of COVID-19 patients. He et al. (2021), developed a one-tube colorimetric assay for the visual detection of SARS-CoV-2 RNA using magnetic beads for fast RNA extraction and rapid isothermal amplification. The assay was tested against the gold standard test RT-qPCR test by using 29 clinical specimens and showed high specificity.

Cherkaoui et al. (2021), developed a multiplexed SARS-CoV-2 molecular test using reverse transcription recombinase polymerase amplification to simultaneously detect two targets. The developed dipstick demonstrated potential for point-of-care testing, offering valuable advantages over gold standard tests.

An intelligent face mask based on a flexible immunosensor using a high-density conductive nanowire array, a miniaturized impedance circuit, and operating via wireless communication was developed by Xue et al. (2021) They demonstrated this point-of-care (POC) system for coronavirus spike protein and whole virus aerosol detection in simulated human breath.

Raziq et al. (2021), reported a MIP-based electrochemical sensor to detect SARS-CoV-2 nucleoprotein. This sensor was connected to a portable potentiostat and shown to detect nucleoprotein presence in nasopharyngeal swab samples of COVID-19 positive patients.

We wish the articles included in this issue will be very useful for further research and validation studies that contribute to improving the current diagnostic tools used as point-of-care devices for COVID-19 prevention, diagnosis, and prognosis, including other applications in the future.

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Arben Merkoçi*

Nanobioelectronics & Biosensors Group, Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC, BIST, Campus UAB, 08193, Bellaterra, Barcelona, Spain

ICREA, Institució Catalana de Recerca I Estudis Avançats, Barcelona, Spain

Chen-zhong Li

Center of Cellular and Molecular Diagnosis, Tulane University School of Medicine, New Orleans, LA, 70112, USA

E-mail address: chenzhongbiosensor@gmail.com.

Laura M. Lechuga

Nanobiosensors and Bioanalytical Applications (NanoB2A), Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC, BIST and CIBER-BBN, 08193, Bellaterra, Barcelona, Spain

E-mail address: laura.lechuga@icn2.cat.

Aydogan Ozcan

Electrical & Computer Engineering and Bioengineering Departments, University of California, Los Angeles (UCLA), CA, 90095, USA

E-mail address: ozcan@ucla.edu.

* Corresponding author.

E-mail address: arben.merkoci@icn2.cat (A. Merkoçi).