International Journal of Frontiers in
Biology and Pharmacy Research
Journal homepage: https://frontiersrj.com/journals/ijfbpr/
ISSN: 2783-0454 (Online)

(REVIEW ARTICLE)

Check for updates

Assessment of facile biosensors for rapid detection of Coronavirus a review for designing real-time monitoring systems

David P Tokpah [1, 2, *], Ali IŞIN [1] and Hatice Erkurt [2]

[1] *Cyprus International University, Department of Bioengineering, Nicosia, North Cyprus, Mersin 10, Turkey.*
[2] *Central Agricultural Research Institute (CARI), Department of Natural Resource Management, Suakoko, Bong County, Liberia.*

International Journal of Frontiers in Biology and Pharmacy Research, 2021, 01(02), 036–041

Publication history: Received on 19 November 2021; revised on 26 December 2021; accepted on 28 December 2021

Article DOI: https://doi.org/10.53294/ijfbpr.2021.1.2.0051

Abstract

The fact that there is no origin for the coronavirus as mentioned by the World Health Organization means humans may have created the virus. Currently, the universe is facing a global health emergency due to the coronavirus pandemic. Getting infected cases out of the way and quarantining contact persons must still produce fruitful results or be controlled. Assessment of facile biosensors for rapid detection of coronavirus acknowledged the evaluation of recent plans unearth by the world researchers and bioengineers concerning ways to contain coronavirus pandemic thru fast testing, especially through assessment of facile biosensors. Biosensors as useful analytical devices emphasized the detection of viral RNAs, fully viral samples, antibodies and biomarkers of different capacities in the human sample. From now on we are seriously reviewing the recently developed extensive biosensor strategies, especially for the rapid detection of coronavirus pandemics.

Keywords: SARS-CoV-2; COVID-19; Rapid: Point-of-care testing; Coronavirus; Facile Biosensor

1 Introduction

The cutting-edge pandemic, the coronavirus ailment was formally delivered as a pandemic via (World Health Organization, 2020). According to the World Health Organization, coronavirus uses its protein spikes to enter the cell and delays the immune system's response so that if the immune machine reacts, contamination is so advanced that it would be difficult to fight) (Guevara Carrion et al., 2011), The third infection of the coronavirus from animals to humans is a respiratory syndrome in the Middle East.

Researchers are investigating SARS-CoV with the aim of achieving a faster response to the angiotensin exchange enzyme II (ACE2) as a mobile entry receptor and facilitating access to identical cell strains (Hoffmann et al., 2020). In the wake of the sector to prevent the virus from invading cellular viral replication or delaying the immune, machine (Seo et al., 2020).

Researchers around the world are intensifying research on new and emerging biosensor technologies for antibody detection. (WHO, 2020). Although the traditional technology inclusive of quantitative real-time polymerase chain reaction (qRT-PCR) cost labor, and time-ingesting and subsequently they are the gold standard for biosensor design (Choi, 2020). The preliminary report of this stud is now being reviewed and based on biosensors for rapid detection and computer modeling of the virus's ability to infect various animals, including humans. Henceforth, the present-day

* Corresponding author: David P Tokpah
Cyprus International University, Department of Bioengineering, Nicosia, North Cyprus, Mersin 10, Turkey.

Copyright © 2021 Author(s) retain the copyright of this article. This article is published under the terms of the Creative Commons Attribution Liscense 4.0.

lateral flow-based totally on mature structures, with greater rapid detection procedure evolved with the assist of biosensor and 3D printing, etc. for effective screening of Coronavirus.

2 Microfluidic-incorporated biosensor numerical platform

This review represents a reliable and stable numerical model together with convection, diffusion, and reaction of target molecules completely on a CVFEM basis. The model simulates a microfluidic embedded biosensor, which the input values and consequences of a good agreement with the already available information from modified the ratings. As acknowledged, Fig. 1. demonstrates four step of designing a microfluidic-incorporated biosensor. Step 1, the virus and its origins are studied, step 2, conceptual design of a microfluidic-incorporated biosensor. Step 3, the numerical version simulates the buffer fluid flow, convection, diffusion, and reaction of the centered molecules inside the biosensor reviewed and step 4, layout optimization on the consequences, outcomes maximum design parameters at the performance of the designed biosensor evaluated.

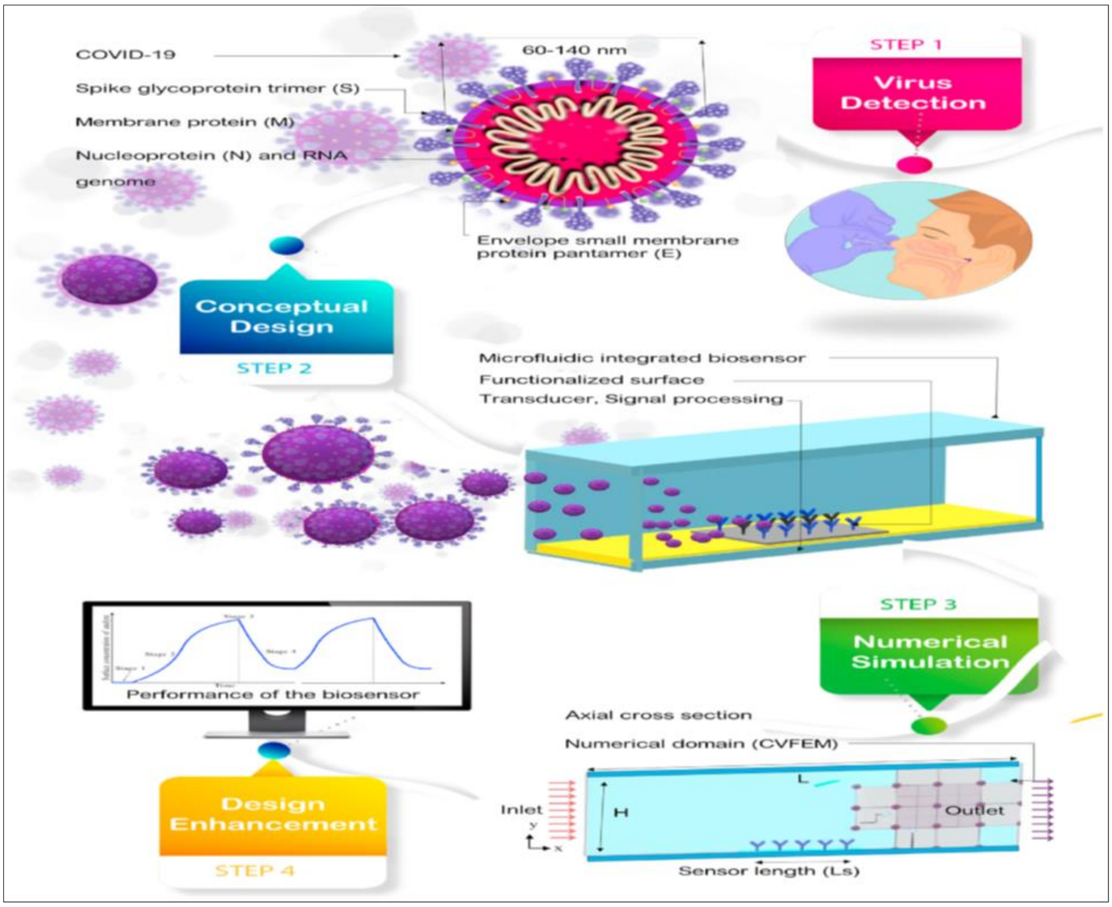

Figure 1 Four ranges of designing biosensors using computational fluid dynamics. Step 1 examines the virus and creates a conceptual design, Step 2 performs numerical analysis and improves the design, and Step 4 deals with the results of the simulation

3 Assessment of nucleic acids

Biosensors as analytical devices are sensitive readout alerts, and assessment of Coronavirus. Henceforth, changed into diagnosing COVID19 diagnosis with a 12-copy LOD based on the reaction in 1-h multiplex RTLAMP together with a side-floating biosensor, which is mainly based on nanoparticles, has been switched. (MRT-LAMP-LFB) (Zhu et al., 2020b). A crispr-biosensor was developed (short palindromic repetitions of CRISRR (cluster interruptions) combined with a lateral float test for SARSCOV2, which allows a result by about 30 minutes (Fig.2a) (Broughton, J.P., et al.., 2020). RNAs from COVID19, patient sample extraction, simultaneous reverse transcription and loop-mediated isothermal amplification (LTRLAMP) at 65 ° C for 20 minutes, followed by Cas12 detection of predefined coronavirus sequences at 37 ° C for 10 minutes, and the molecule is confirmed. (Qiu et al., 2020), In addition to a practical double plasmon biosensor that combines photothermal plasmon burst (PPT) and localized surface plasmon resonance detection transduction (LSPR), it should be an alternative to the medical detection of supply (Fig. 2B). This biosensor relieves PCR-based evaluations and offers a clean, reliable prognosis platform to improve the diagnostic accuracy of medical check-ups. Therefore (Jiao et al., 2020) developed a fluorescence biosensor that is based entirely on DNA nano scaffold hybrid chain reaction (DNHCR) for the rapid detection of SARSCoV2RNA (Figure 2C). In this biosensor, the self-extinguishing probes (H1) act as detection details, and the DNA nano-scaffolds are built up through the self-organization of long strands of DNA. H2-DNA examines the nano-scaffold to shed light on the DNA nanochain and shows virus awareness. This DNHCR biosensor can detect SARSCoV2 in 10 minutes and under mild conditions (15-35 ° C) and shows excellent capabilities in recurring medical prognosis.

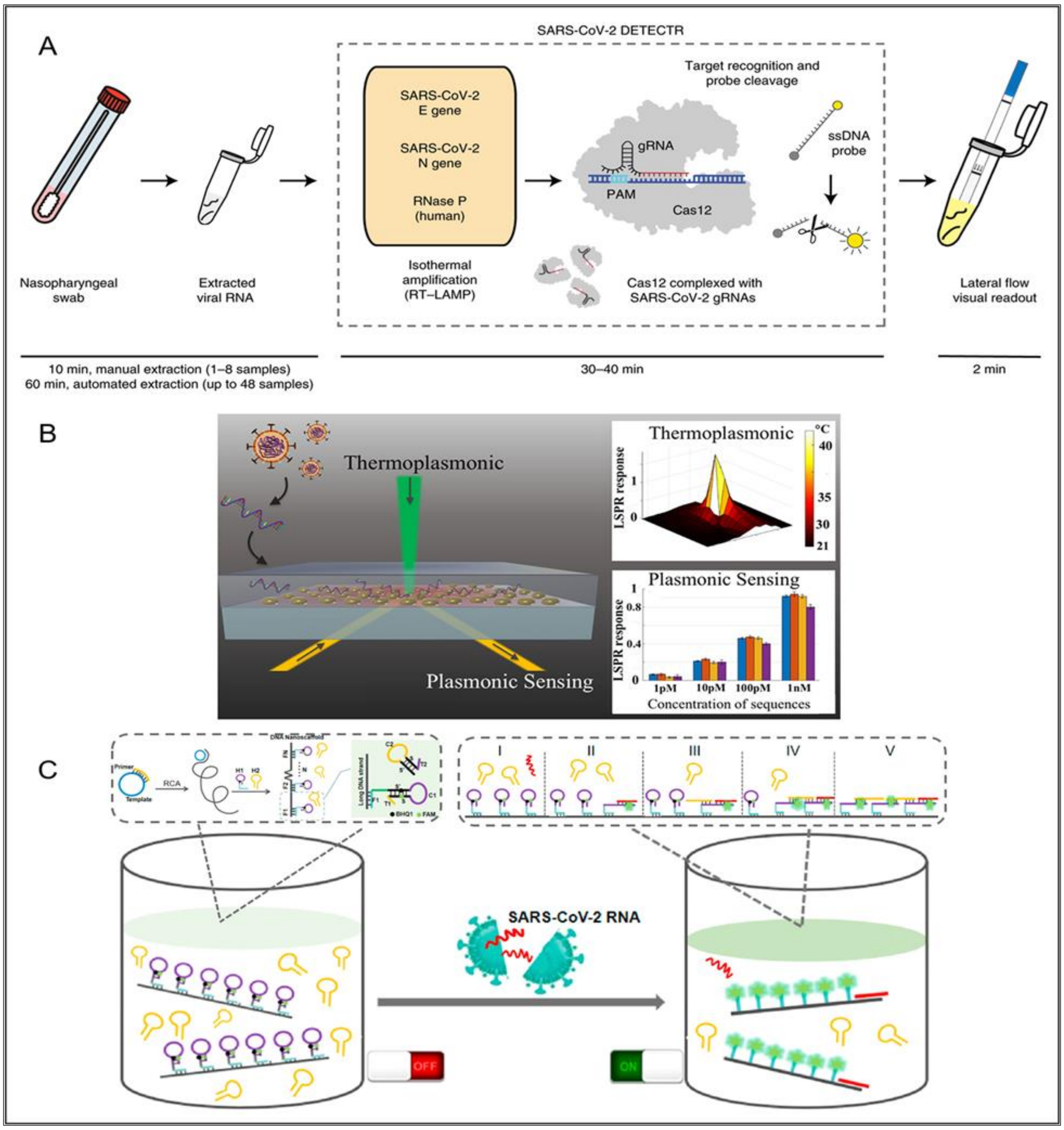

Figure 2 Detection of SARSCoV2-RNA via way of means of biosensors. (A) SARSCoV2 detector workflow. RNA extraction detector visualized via way of means of a fluorescence reader (Broughton et al., 2020). (B) Localized floor plasmon resonance (LSPR) detection with dual-feature plasmon biosensor for medical analysis of COVID19 (Qiu et al., 2020). (C) Biosensor primarily based totally at the DNA nano-scaffold hybrid chain reaction (DNHCR) for the detection (Jiao et al., 2020)

4 Assessment of surface antigens

The development of a diagnostic or detection tool for COVID19 has been the subject of some relevant research studies. quick and easy detection of COVID19 (Fig. 3A) biosensor mainly based on DNA nano-scaffold hybrid chain reaction (DNHCR) for the detection of SARSCoV2RNA (Zhang et al., 2020b). Coronavirus debris in preference to natural antigen proteins examined for assay validation, and clinical trials, review represents evidence-of-concept and proven the capability of the Gr-FET era for touchy and speedy detection. Interestingly, another graphene biosensor device is based on an impact transistor (FET) and was coated with a specific antibody against the SARSCoV2 protein spike for the direct detection of SARSCoV2. (Figure 3B) (Seo et al., 2020). This review discovers the high sensitivity of the assay with nothing short of false positives and looks for ways to enable realistic programs. Then graph sensors and FET technology are used to detect cells, exosomes, and biomolecules in bio-fluids. (Delle et al., 2018).

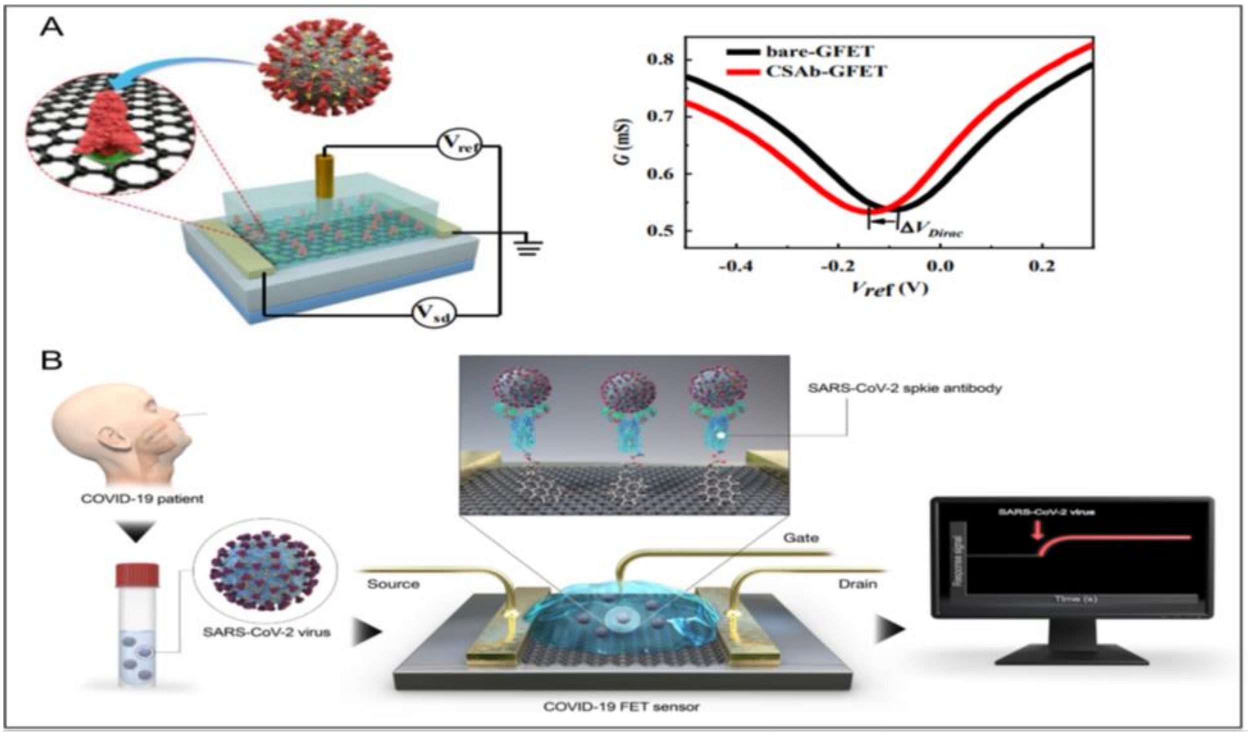

Figure 3 Detection of the viral antigen SARSCoV2 by biosensors. (A) The discipline of grapheme concerns transistors for electrical probing of antigens from the 2nd history of SARSCoV (X. Zhang et al., 2020b). (B) Shock transistor-based biosensor for the rapid detection of the SARSCoV2 virus in humans (Seo et al., 2020)

5 Assessment of Mitochondrial Reactive Oxygen (ROS) disposable sensor

In this evaluation, this evaluation evolved a diagnostic mechanism primarily based totally on early strains of mitochondrial reactive oxygen types (ROS) and evolved (Miripour et al., 2020). This Mitochondrial Reactive Oxygen disposable sensor is a diagnostic component device, an incorporated transportable automated electrochemical readout board, and a sample-retaining unit (Fig. 3A). The sensor of 3 electrodes (Working (WE), Counter (CE), and Reference (RE)) with a triangular distance of three mm from every different can sensitively degree cutting-edge sign sample (Fig. 3B) below sweeping capacity ranging 0.eight to 0.eight V with a test charge of a hundred mV/s. Compared to scientific diagnostics (n > 140 affected person samples), extra than 97% of right outstanding sufferers had been detected at the same time as the ROS sensor declares analysis in much less than 30 s.

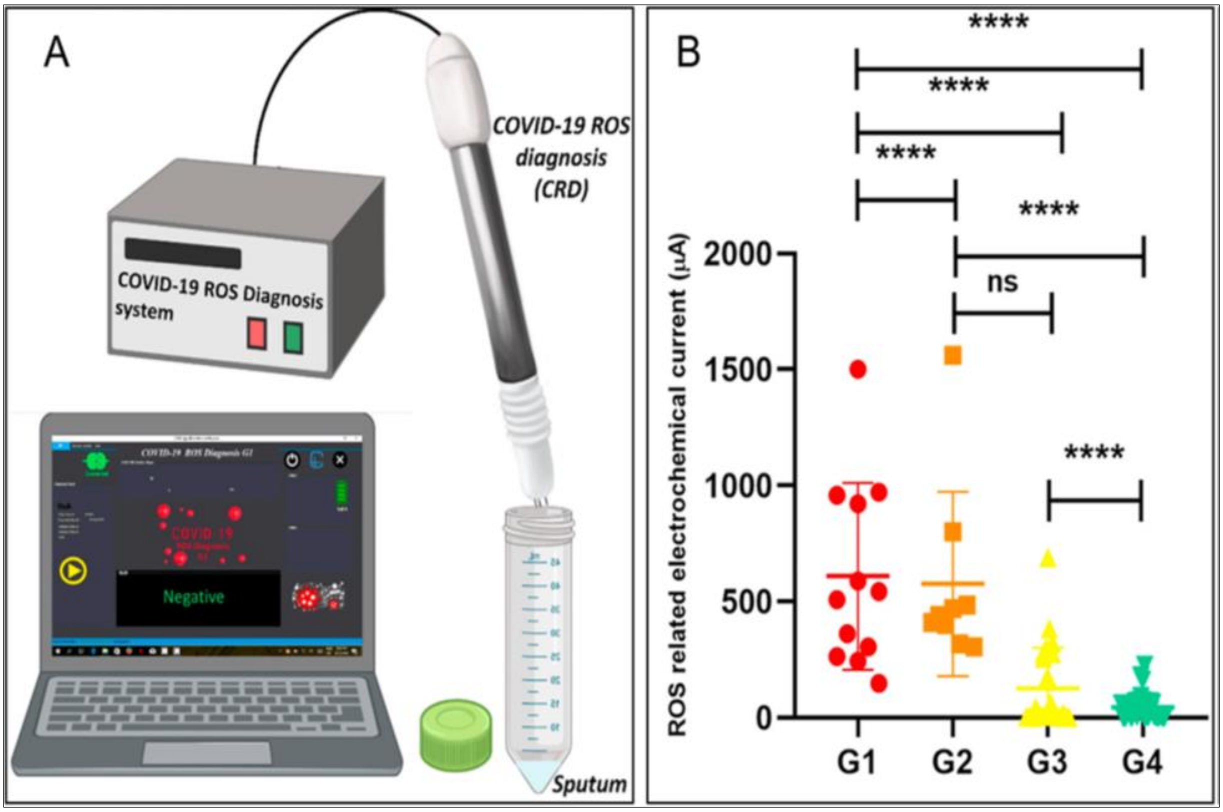

Figure 4 COVID-19 ROS analysis device includes 3-needle electrodes nanotubes functionalized multi-wall carbon (A) Current dimension for differentiating affected person samples (B). G1: hospitalized in ICU; G2: hospitalized without want to ICU care; G3: PCR high quality nonhospitalized; G4: PCR bad wholesome controls (Miripour et al., 2020)

6 Conclusion

We acknowledge the COVID-19 pandemic from the stunning range of deaths and massive monetary disasters involved. Hence, it indicators us for any viral or different pathogenic microbial outbreaks withinside the future. Therefore, it is important and imperative to develop laboratory-independent, hospital-decentralized, personalized and point-of-care diagnostic approaches with inexpensive, fast and portable detection with high throughput. Aptamers and bioengineering enable greater detection specificity than new intelligent detection approaches that use the ultra-high sensitivity of biosensors combine with advances in artificial intelligence bits (Jeong et al., 2020). Henceforth, this review clearly referenced the prevention and management of potential future epidemics.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

References

[1] Broughton JP, Deng X, Yu G, Fasching CL, Servellita V, Singh J, Miao X, Streithorst JA, Granados A, Sotomayor-Gonzalez A, Zorn K, Gopez A, Hsu E, Gu W, Miller S, Pan CY, Guevara H, Wadford DA, Chen JS, Chiu CY. CRISPR–Cas12-based detection of SARS-CoV-2. Nat. Biotechnol. 2020; 1–5.

[2] Choi JR. Development of point-of-care biosensors for COVID-19. Front. Chem. 8: 517.

[3] Delle LE, Pachauri V, Sharma S, Shaforost O, Ma H, Adabi M, Lilischkis R, Wagner P, Thoelen R, Klein N, O'Kennedy R, Ingebrandt S. ScFv-modified graphene-coated IDE-arrays for 'label-free' screening of cardiovascular disease biomarkers in physiological saline. Biosens. Bioelectron. 2018; 102: 574–581.

[4] Guevara-Carrion G, Hasse H, Vrabec J. Thermodynamic properties for applications in chemical industry via classical force fields. Multistage Mol. Methods Appl. Chem. Springer. 2011; 201–249.

[5] Huang Z, Tian D, Liu Y, Lin Z, Lyon CJ, Lai W, Fusco D, Drouin A, Yin X, Hu T, Ning B. Ultra-sensitive and high-throughput CRISPR-p owered COVID-19 diagnosis. Biosens. Bioelectron. 2020; 164: 112316.

[6] Jeong H, Adv S, Jeong Hyoyoung, Rogers JA, Xu S. Continuous on-body sensing for the COVID-19 pandemic : gaps and opportunities. Sci. Adv. 4794. 2020; eabd4794.

[7] Jiao J, Duan C, Xue L, Liu Y, Sun W, Xiang Y. DNA nanoscaffold-based SARS-CoV-2 detection for COVID-19 diagnosis. Biosens. Bioelectron. 2020; 167: 112479.

[8] Miripour ZS, Sarrami-Forooshani R, Sanati H, Makarem J, Taheri MS, Shojaeian F, Eskafi AH, Abbasvandi F, Namdar N, Ghafari H, Aghaee P, Zandi A, Faramarzpour M, Hoseinyazdi M, Tayebi M, Abdolahad M. Real-time diagnosis of reactive oxygen species (ROS) in fresh sputum by electrochemical tracing; correlation between COVID-19 and viral-induced ROS in lung/respiratory epithelium during this pandemic. Biosens. Bioelectron. 2020; 165: 112435.

[9] Qiu J. Covert coronavirus infections could be seeding new outbreaks. Nature. 2020.

[10] Seo G, Lee G, Kim MJ, Baek SH, Choi M, Ku KB, Lee CS, Jun S, Park D, Kim HG, Kim SJ, Lee JO, Kim BT, Park E.C, Kim S. Rapid detection of COVID-19 causative virus (SARS-CoV-2) in human nasopharyngeal swab specimens using field-effect transistor-based biosensor. ACS Nano. 2020; 14: 5135–5142.

[11] World Health Organization. Coronavirus Disease (COVID-2019) Situation Reports - 147. 2020.

[12] World Health Organization, 2020b. WHO Director-General's opening remarks at the media briefing on COVID-19 - 16 March 2020 [WWW Document]. 2020.

[13] Zhang X, Qi Q, Jing Q, Ao S, Zhang Z, Ding M. Electrical probing of COVID-19 spike protein receptor binding domain via a graphene field-effect transistor arXiv. 2020; 1–20.

[14] Zhu X, Wang X, Han L, Chen T, Wang L, Li H, Li S, He L, Fu X, Chen S, Xing M, Chen H, Wang Y. Multiplex reverse transcription loop-mediated isothermal amplification combined with nanoparticle-based lateral flow biosensor for the diagnosis of COVID-19. Biosens. Bioelectron. 2020; 166: 112437.