On the road to the control and overseeing of COVID-19 diagnosis and monitoring through versatile and efficient multiplexed electrochemical biosensing tools

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Control and management of infectious diseases have gained tremendous importance since COVID-19 was officially declared as a global pandemic. Currently, and especially with the introduction of COVID-19 vaccination protocols as well as with the emergent SARS-CoV-2 variants, immune response tracking to SARS-CoV-2, critically required for a deeper understanding of the extent of the infection, represents the basis for an 'immunity passport' enabling individuals to return to normal life [1]. However, assuming vaccines are not 100 % effective, a breakthrough infection could be expected. Since people who get vaccine breakthrough infections can be contagious [2], interrogation of a broad spectrum of COVID-19 related markers for discriminating infectious, vulnerable, and/or immune-population, either vaccine-protected or unvaccinated, continues to be of paramount demand.

Inspired by the willingness to cooperate for this purpose, we present two simple and effective interrelated electrochemical biosensing devices based on both laser-engraved graphene-[3] and magnetic beads-coupled screen-printed electrodes for the sensitive, fast, and reliable multiplexed interrogation of viral antigen (nucleocapsid protein, NP), SARS-CoV-2 specific immunoglobulins (IgGs and IgMs), and the inflammatory biomarker C-reactive protein, as well as total and specific-isotypes SARS-CoV-2 immunoglobulins (IgGs, IgMs, and IgAs) against the most antigenic viral receptors: spike (S) and nucleocapsid (NP)-antigens, respectively.

The factual applicability of both biosensing tools has been extensively demonstrated by analyzing RT-PCR confirmed COVID-19-positive and -negative blood and saliva samples from healthy and SARS-CoV-2 infected subjects. Results provided by both multiplexed bioplatforms agree admirably with those proffered by other methodologies that require more effort, knowledge, and application in centralized environments, thus corroborating the reliable and suitable performance of the established methodologies.

All this proves beyond doubt that electrochemical biosensors continue to demonstrate their exceptional capabilities in the fight against one of the most dramatic health and economic crisis of the modern era, paving the way to the implementation of affordable and easily accessible diagnostic devices for the entire population.

References

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