



## Supporting Information

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Innovations and Challenges in Electroanalytical Tools for  
Rapid Biosurveillance of SARS-CoV-2

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Table S1. Common standards required for commercializing point-of-care devices

Standard Organization	Title/Number
Food and Drug Administration (FDA)	1976: Medical Device Amendments to Federal Food, Drug and Cosmetic Act (FD&C Act)
	2017: Food and Drug Administration Reauthorization Act (FDARA), Code of Federal Regulations Title 21
	Clinical Laboratory Improvement Amendments (CLIA) 1988
World Health Organization (WHO)	medical device regulations global overview and guiding principles
International organization for standardization (ISO)	22870:2006 Point-of-care testing
	Requirements for quality and competence, 14971:2000: risk analysis, risk evaluation and risk control for risk management in medical device design, development, and manufacturing
	13485: quality management for medical devices, 20417:2021: Medical devices — Information to be supplied by the manufacturer
	27001: information security management
international electrotechnical commission technical committee (IEC TC)	29: Electroacoustics
	62: electrical equipment
	ISO/TC (194: biological evaluation of medical devices, 198: sterilization of health care products

Table S2. Electrochemical biosensors for SARS-CoV-2 detection

Sensing electrode	Target	Biofluid	Time (min)	Amplification	Mechanism	Range	LOD	Ref
<b>Chronoamperometry</b>								
Graphene/PBA:EDC:NHS/specific receptors (multiplex)	NP, CRP, S1-IgM, S1-IgG	Saliva, blood	15	Enzymatic signal enhancement	NP: double sandwich immunoassay CRP: sandwich immunoassay S1-IgM and IgG: HRP-labeled immunoassay	-	NP: 500 pg/mL CRP: 50 ng/mL S1-IgM and IgG: 250 ng/mL	[1]
Assay: DMB/HRP/dAb SPGE/ 2-iminothiolane/cAb	NP	Serum	60	Dually labeled magnetic nanobeads	Sandwich ELISA	-	10 pg/mL	[2]
Au/DNA/ferrocene/CR3022 cAb	S1	Saliva	60	-	Direct, reagent-free, hydrodynamic drag force	1-100 pg/mL	1 pg/mL	[3]
<b>CV</b>								
Paper/graphene/AuNps-capped aptamers	N gene	nasopharyngeal	5	-	Affinity immunosensor	585.4 copies/ $\mu$ L to $5.854 \times 10^7$ copies/ $\mu$ L,	6.9 copies/ $\mu$ L	[4]
Electrode: Glass/Au/DSP/Gox/BSA Assay: streptavidin coated MBs/BSA/ biotinylated ssDNA/ complementary thiolated ssDNA- Invertase	S and N protein	salivary	90	Enzymatic signal enhancement	Competitive enzyme linked immunoassay	N protein: 3.5- 226 pM S protein: 2-128 pM	N protein: 0.71 pM S protein: 0.34 pM	[5]
<b>EIS</b>								
AuNP /rGO/S1-RBD antigens	S1 and RBD Ab	Serum	1	-	Competitive immunoassay	-	S1: 2.8 fM RBD: 1 pM	[6]
Au/RBD/milk	CR3022	serum	60	-	Competitive immunoassay	-	0.1 $\mu$ g/ml	[7]
Au/PFDT/ACE2	Spike proteins	saliva	30	-	ACE2 and spike protein physisorption	1-100 ng/mL	38.6 copies/mL	[8]
<b>DPV</b>								
Premix A) AuNP@Fe <sub>3</sub> O <sub>4</sub> /HT/CP Premix B) SCX8-RGO/TB/AuNP/LP, AP On a SPCE	RNA	Sputum, Throat swab, saliva, urine, plasma, feces, oral, serum, blood	180	Magnetic enrichment	Supersandwich immunoassay	-	200 copies/mL	[9]
Assay: MBs-anti mouse IgG/MAB anti S or N protein/PAb anti S or N protein/PAb anti rabbit-AP/1-Naphthyl phosphate disodium Electrode: graphite-CB modified	Spike S or N proteins	saliva	40	Magnetic enrichment	Sandwich immunoassay	-	S:19 ng/mL N:8 ng/mL	[10]

Sensing electrode	Target	Biofluid	Time (min)	Amplification	Mechanism	Range	LOD	Ref
<b>DPV</b>								
GCE/PANI nanowire/antifouling peptide-biotin/biotin-cAb/SA	N gene	serum	60	-	Competitive immunoassay	10–14 to 10–9 M	3.5 fM	[11]
Electrode: SPCE Assay: aptamer (CP)-MNB/aptamer (RP)-Si/RCA amplicons	N and S gene	nasopharyngeal	120	RCA	Sandwich immunoassay	1 to $1 \times 10^9$ copies/ $\mu$ L	1 copy/ $\mu$ L	[12]
GCE/BSA-NW/peptide aptamer	IgG	serum	90	-	Competitive immunoassay	1 ng/mL – 10 $\mu$ g/mL	0.27 ng/mL	[13]
Au/phenylenediamine-based MIP	ncovNP	nasopharyngeal	15	-	Charge transfer hinderance upon target-molecular cavity interaction	50-111 fM	15 fM	[14]
<b>SWV</b>								
Graphene/carboxylated paramagnetic beads/PBASE/cAb/BSA	Spike S protein	N.M	60	-	Competitive label-free immunoassay	-	260 nM (20 $\mu$ g/mL) spike S protein and $5.5 \times 10^5$ PFU/mL virus	[15]
Paper/GO/RBD/milk	IgM, IgG	serum	45	-	Competitive label-free immunoassay	1 ng/mL	0.1-50 $\mu$ g/mL	[16]
CNF/CP/cAb/BSA	N protein	nasopharyngeal	20	-	Competitive label-free immunoassay	0.8 pg/mL	-	[17]
Au SPE/MCH/ssDNA capture probe MB-tagged signaling probe	synthetic genome fragments of SARS-CoV-2	-	120	PER	CRISPR-mediated competitive immunoassay	-	25-100 nM	[18]
<b>ECL</b>								
Au/DT/Ru(bpy) <sub>3</sub> <sup>2+</sup>	RdRp gene	serum	75	Entropy-driven cascade amplifying	Competitive ECL-labelled immunoassay	2.67 fM	0.01-100 pM	[19]

#### Abbreviations

RBD	Receptor binding domain
AuNP	Gold nanoparticle
PDMS	polydimethylsiloxane
rGO	Reduced graphene oxide
ag	antigen
ab	antibody
POC	Point of care
NP	nucleocapsid protein
Ig	immunoglobulin
CRP	C-reactive protein

LEG	laser-engraved graphene
PBA	1-pyrenebutyric acid
WE	Working electrode
SCX8	p-sulfocalix[8]arene
TB	toluidine blue
SPCE	Screen printing carbon electrode
HT	hexane-1-thiol
DMB	dually-labeled magnetic nanobeads
SPGE	Screen printing gold electrode
(PBASE)	1-pyrene butyric acid N-hydroxysuccinimide ester
(6-MCH)	6-mercaptohexanol

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