

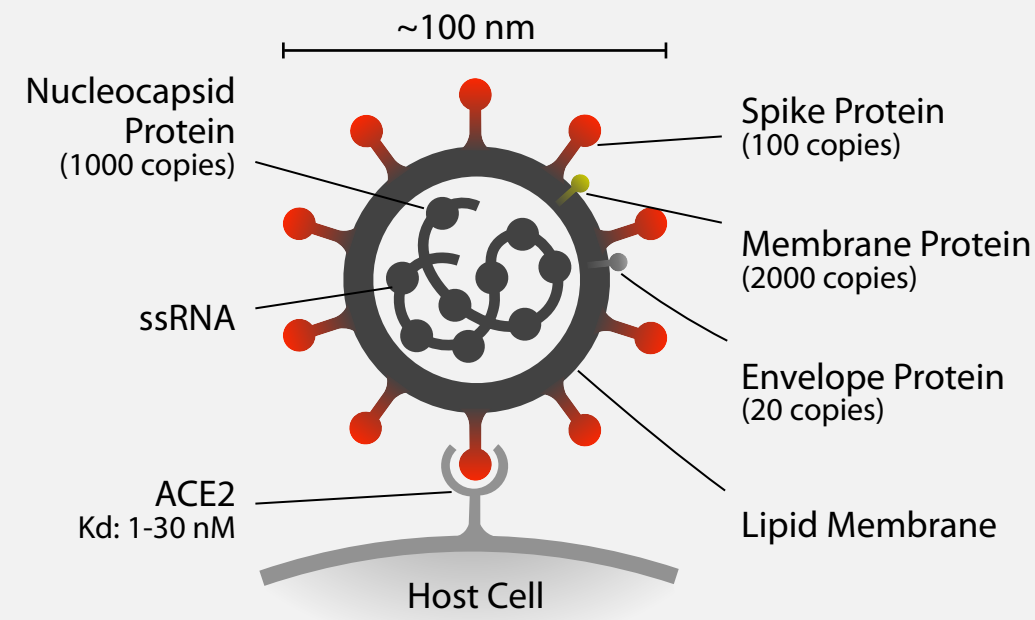
# COVID-19 Diagnostics In Context

Ralph Weissleder, Hakho Lee, Jina Ko, Mikael J. Pittet

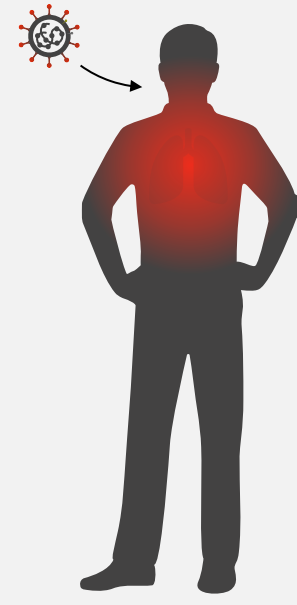
For updated version see here  
Version v1.32 (5/16/2020)



## Viral composition



## Clinical factors



### Timing

- **Incubation:** ~5d after exposure (range 2-14d)
- **Symptoms:** ~12d after exposure (range 8-16d, or *never*)
- **Infectiousness:** before onset of symptoms
- **Seroconversion:** ~5-10d after symptom onset
- **Diagnosis of infection:** typically after onset of symptoms

### Viral Concentrations \*\*\*

- Nasal ( $10^{6-9}$  RNA/swab)
- Throat ( $10^{4-8}$  RNA/swab)
- Sputum ( $10^{6-11}$  RNA/mL)
- Stool ( $10^{4-8}$  RNA/g)
- Blood (low levels)
- Urine (not detectable?)

### Variables Affecting Disease Severity \*\*

- Sex ( $\delta > \text{♀}$ )
- Age (Old > Young)
- Cardiovascular diseases, cancer, respiratory diseases, diabetes, others

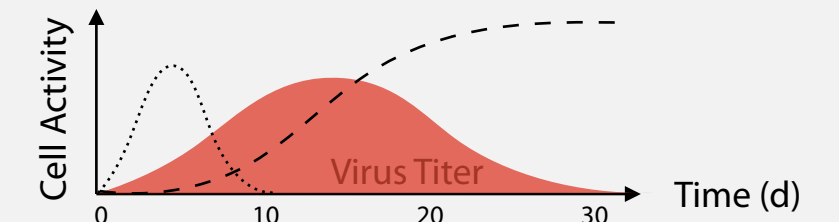
### Impact

- Confirmed cases, outcomes, simulators, others: [JHU Covid Center](#); [MGH Simulator](#); [Our World In Data](#); [NYT](#)

## Immune responses & outcomes

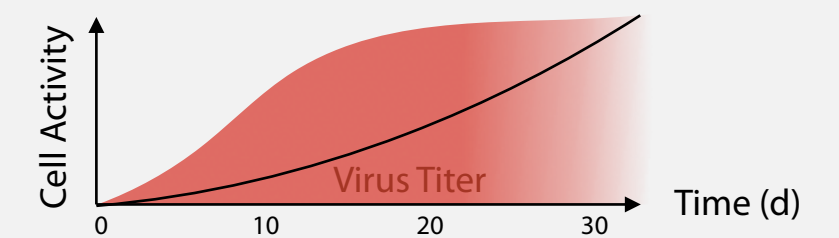
### Good outcome \*\*\*

- Innate immune cells, type I interferon, others
- Adaptive immune cells (T cells, B cells and associated immunoglobulins [IgM, IgG, IgA])



### Bad outcome \*\*\*

- Inflammatory cells (monocytes, neutrophils) and cytokine storm (IL-1, IL-6, TNF- $\alpha$ , others)



## Nucleic acid tests (NATs, for viral RNA)

**Most common targets:** Viral genome sequence #MN908947 \*\*\*

- CDC approved targets: N1, N2 genes (single or multiple)
- Other emerging targets: E gene, S gene, Orf1ab gene, RdRP gene

**Key reagents:** CDC approved kits include 2019-nCoV CDC Probe and Primer Kit for SARS-CoV-2 (Biosearch Technologies) and 2019-nCoV Kit (IDT), rRT-PCR Enzyme Mastermix from Quantabio, Promega, and ThermoFisher

### 1. Real time RT-PCR

- Widely available, highly specific method. Uses thermal cycling based amplification of nucleic acids from SARS-CoV-2. Main types:
  - Quantitative PCR (qPCR): highly sensitive, widely available and current standard
  - Droplet digital PCR (ddPCR): absolute quantification, 5-plex, reference not needed
- Developers: Roche, LabCorp, PerkinElmer (RUO), Mesa Biotech, Cepheid, Qiagen, Thermo Fisher, BioRAD (Research Use Only, RUO)

### 2. Isothermal amplification

- Ultra-fast method that does not require thermal cycling. Potential for point-of-care (POC) use. Main types:
  - Loop mediated isothermal amplification (RT-LAMP): one-step amplification at 60-65 °C; more sensitive than conventional RT-PCR
  - Sequence specific LAMP: more robust and specific compared to regular LAMP
  - Rolling circle amplification (RCA): uses a circular template, simple and efficient
  - Nicking endonuclease amplification reaction (NEAR): ultra-fast (<10 min) amplification at 37-42 °C, as sensitive as qPCR
- Developers: Atila Biosystems, Abbott

### 3. CRISPR

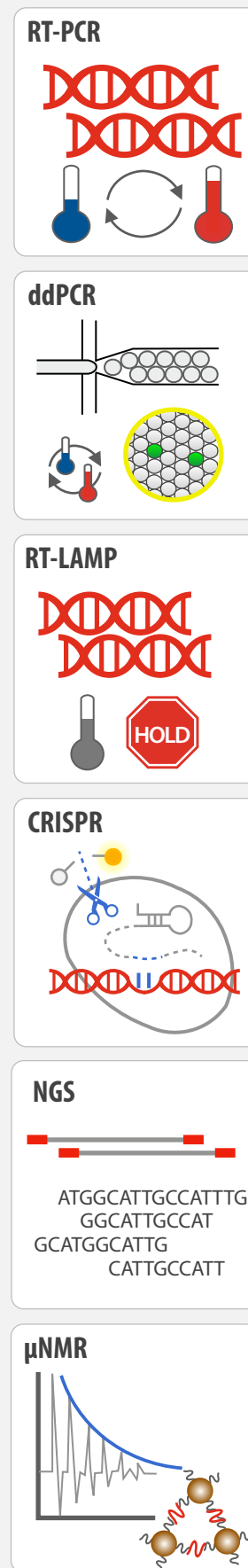
- Different methods (CAS12a or CAS13a) currently in development for POC use
- Simple readout (lateral flow detection). Rapid (<1 hr) and specific
- Developers: Mammoth Biosciences (DNA endonuclease-targeted CRISPR trans reporter; DETECTR), SHERLOCK Biosciences (COVID-19 detection protocol)

### 4. Next generation sequencing (NGS)

- Primarily used to track transmission routes globally, population management, viral mutation and discovery of targets for therapy.
- Developers: Illumina (Shotgun metagenomic sequencing), Thermo Fisher (Ion AmpliSeq SARS-CoV-2)

### 5. Micro NMR ( $\mu$ NMR)

- Uses magnetic assays to detect PCR products
- Does not require lengthy sample purification. Developers: T2 Biosystems



## Protein tests (immunoglobulins, viral antigens)

**Most common targets:** human IgG, human IgM; IL-6 and other interleukins; Viral antigens: nucleocapsid (N) protein and spike (S) protein \*\*\*

**Key reagents:** antiviral IgG, IgM; recombinant N and S proteins

### 1. Serological rapid diagnostic test (RDT)

- Detects SARS-CoV-2 IgG/IgM in blood using lateral flow assay (LFA)
- Rapid (<20 min), qualitative, equipment-free
- Colorimetric read out (gold nanoparticles)
- Developers: Cellex, BioMedomics, Sugentech, SD Biosensor, RayBiotech, 20/20 GeneSystems, Surescreen Diagnostics

### 2. Serological ELISA

- Detects SARS-CoV-2 IgG/IgM on a plate coated with capture agents
- High throughput, quantitative, multiple formats (ECLIA, EIA, FIA, ECS)
- Signal amplification allows low detection limit (~pM)
- Uses blood samples
- Developers: Eagle Bioscience, RayBiotech, Creative Diagnostics, Epitope Diagnostics, Accure Health

### 3. Viral antigen tests (VAT)

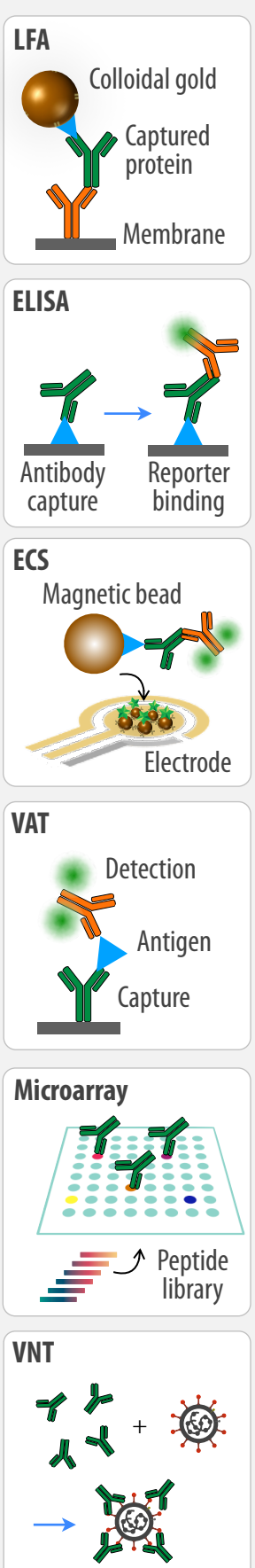
- Detects viral nucleocapsid N or S proteins using capture antibodies via LFA or ELISA
- Can be used for respiratory tract samples
- Developers: Quidel, Sona Nanotech, RayBiotech, SD Biosensors, Bioeasy

### 4. Microarrays

- Discovery of IgG/IgM targets at the epitope level
- Peptide-coated chips are used to capture IgG/IgM
- Applications in diagnostics, vaccine research
- Developers: PEPperPRINT (PEPperCHIP<sup>®</sup>, 4883 peptides), State Key Laboratory of Proteomics (China)

### 5. Other methods

- Virus neutralization test (VNT): detects presence of active antibodies
- Western blots (WB): detects viral proteins
- Immunofluorescence microscopy (IFM): antibody interaction with virus proteins



## Performance comparison of different test types

FDA Cleared tests:

Total **90**

FDA-EUA NAT **59**

LDT-EUA NAT **18**

FDA-EUA Prot **13**

Type	Target	Virus	Assay time	Process type	FDA-EUA	Examples (# FDA-EUA cleared; see next page for details)
PCR	Viral RNA	SARS-CoV-2	2-8 h; >12h	Plate	50	#Roche, #LabCorp, #BioMerieux, #Qiagen, #Perkin-Elmer, #Becton Dickinson, #Luminex, #Thermo Fisher
PCR-POC	Viral RNA	SARS-CoV-2	<1 h	Cartridge	2	#Cepheid, #Mesa, Credo
ddPCR	Viral RNA	SARS-CoV-2	2-4 h	Manual	1	#BioRAD
NEAR	Viral RNA	SARS-CoV-2	15 min	Cartridge	1	#Abbott
OMEGA	Viral RNA	SARS-CoV-2	1 h	Plate	1	#Atila BioSystems
RCA	Viral RNA	SARS-CoV	2 h		0	
SHERLOCK	Viral RNA	SARS-CoV-2	1.5 h	Kit	1	#Sherlock Biosciences (CAS13a)
DETECTR	Viral RNA	SARS-CoV-2	1 h	Kit	0	Mammoth Biosciences (CAS12a)
NGS	Viral RNA	SARS-CoV-2	Days		1	#IDbyDNA, Vision, Illumina
$\mu$ NMR	Viral RNA	SARS-CoV-2	2 h	Cartridge	0	T2 Biosystems
LFA	IgG, IgM	SARS-CoV-2	15 min	Cartridge	3	#Cellex, #Sugentech, #ChemBio, Innovita
ELISA	IgG, IgM	SARS-CoV-2	2-4 h	Plate	4	#Mount Sinai, #Ortho-Clinical (2), #EUROIMMUN US Inc., BioRAD, Snibe, Zhejiang Orient, Creative Dx
CLIA	IgG, IgM	SARS-CoV-2	30 min	Cartridge	2	#Abbott, #DiaSorin
EIA	IgG, IgM	SARS-CoV-2		Plate	1	#BioRAD
MIA	IgG, IgM	SARS-CoV-2		Plate	1	#Wadsworth Center
ECLIA	IgG, IgM	SARS-CoV-2	20 min	Plate	1	#Roche
ECS	IgG, cytokine	SARS-CoV-2	1 h	Cartridge	0	Accure Health
VAT	Viral antigen	SARS-CoV-2	20 min	Cartridge	1	#Quidel, Sona NT, RayBiotech, SD Biosensors, Bioeasy
Microarrays	Ig epitopes	SARS-CoV-2	1.5 h	Plate	0	RayBiotech, PEPperPRINT
IFM	Viral protein	SARS-CoV	3 h	Manual	0	
WB	IgG, IgM; viral protein	SARS-CoV	4 h	Manual	0	

Aggregator websites: [Find](#), [Artis](#), [FDA](#), [WHO](#), [Covid testing](#); #: FDA-EUA cleared tests commercially available

## Applications

### Family/Home

- Simple
- Inexpensive
- Low throughput

### Health Care Facility

- Fast
- High throughput
- High sensitivity

### Population

- Fast
- High throughput
- Inexpensive

## Other useful diagnostics

### Family/Home

- **Symptom apps** (Apple, CDC)
- Distancing apps
- Contact tracing apps
- Wearable sensors (pO<sub>2</sub>)
- Physiological monitoring (temp, HR, RR)
- Thermography

### Hospital

- Blood gas analyzers: Manage hypoxia and ventilation parameters
- Coagulation: Thromboprophylaxis
- Electrolyte analyzers:
- Enzymes: determine and manage multi-organ failure
- CXR, CT: manage pulmonary manifestations



## FDA cleared NATs

Test	Company	Source	Target	Type	Time (h)	Manufacturer data					Trial data*				Use	Clearance
						Sens	Spec	PPV	NPV	LOD	Sens	Spec	PPV	NPV		
<a href="#">1copy COVID-19 qPCR Multi Kit</a>	1drop Inc.	RNA		PCR		NA	NA	100%	100%	200/ml					H	FDA-EUA
<a href="#">ID NOW COVID-19 test</a>	Abbott	RNA		NEAR	5-15 min	100%	100%			125/ml	52%	99%	94%	82%	H/M/W	FDA-EUA
<a href="#">m2000 RealTime SARS-CoV-2</a>	Abbott	RNA		PCR	4-6	NA	NA	100%	100%	100/ml					H	FDA-EUA
<a href="#">Alinity m SARS-CoV-2 assay</a>	Abbott	RNA		PCR		NA	NA	100%	100%	100/ml					H/M	FDA-EUA
<a href="#">RealStar SARS-CoV02 RT-PCR Kits U.S.</a>	Altona Diagnostics	RNA	E, S	PCR	4-6	NA	NA			0.1PFU/ml					H	FDA-EUA
<a href="#">Linea COVID-19 Assay Kit</a>	Applied DNA Sciences	RNA		PCR						1250/ml					H	FDA-EUA
<a href="#">iAMP Covid-19 detection kit</a>	Atila BioSystems	RNA	ORF1ab, N	LAMP (OMEGA)	1	NA	NA	98%	93%	4000/ml					H	FDA-EUA
<a href="#">Avellino CoV2 kit</a>	Avellino Labs	RNA		PCR	24-48	NA	NA	100%	100%	55000/ml					H	FDA-EUA
<a href="#">BD SARS-CoV-2 Reagents</a>	BD	RNA		PCR	2-3					40/ml					H/M	FDA-EUA
<a href="#">BioGX SARS-CoV-2 Reagents</a>	BD	RNA		PCR						40/ml					H/M	FDA-EUA
<a href="#">Real Time Fluorescent RT-PCR kit</a>	BGI	RNA		PCR	2	NA	NA	88.1%	99.6%	100/ml					H	FDA-EUA
<a href="#">Bio-RAD SARS-CoV-2 ddPCR Test</a>	Bio-RAD	RNA		ddPCR		NA	NA	94.9%	94.9%	625/ml					H	FDA-EUA
<a href="#">BioFire COVID-19 Test</a>	BioFire Defense, LLC	RNA		PCR		NA	NA	90%	100%	330/ml					H/M	FDA-EUA
<a href="#">BioFire Respiratory Panel 2.1</a>	BioFire Diagnostics	RNA		PCR		NA	NA	98%	100%	300/ml					H/M	FDA-EUA
<a href="#">BIOFIRE COVID-19 test</a>	BioMérieux	RNA		PCR	<1	NA	NA	100%	100%	380/ml					H	FDA-EUA
<a href="#">2019-nCoV Real-Time RT-PCR Dx Panel</a>	CDC	RNA		PCR	24-48					1000/ml					H	FDA-EUA
<a href="#">Xpert Xpress SARS-CoV-2</a>	Cepheid	RNA		PCR-POC	45 min	100%	100%			250/ml					H/M/W	FDA-EUA
<a href="#">Logix Smart Coronavirus Disease kit</a>	Co-Diagnostics	RNA		PCR	1-2					4290/ml					H	FDA-EUA
<a href="#">QuantiVirus SARS-CoV-2 test</a>	DiaCarta	RNA		PCR	2					100/ml					H	FDA-EUA
<a href="#">Simplexa COVID-19 direct assay</a>	DiaSorin Molecular	RNA		PCR	1	NA	NA	100%	100%	242/ml					H/M	FDA-EUA
<a href="#">FTD SARS-CoV-2</a>	Fast Track Diagnostics	RNA		PCR						0.0023					H	FDA-EUA
<a href="#">Fosun COVID-19 RT-PCR Detection Kit</a>	Fosun Pharma USA	RNA		PCR	2	NA	NA	99.5%	96%	300/ml					H	FDA-EUA
<a href="#">ePlex SARS-CoV-2 test</a>	GenMark Diagnostics	RNA		PCR	2					10/ml					H/M	FDA-EUA
<a href="#">GS COVID-19 RT-PCR KIT</a>	GenoSensor	RNA		PCR	4-6	NA	NA	100%	100%	1000/ml					H	FDA-EUA
<a href="#">COVID-19-RT-qPCR Detection Kit</a>	Gnomegen	RNA		PCR		NA	NA	100%	100%	500/ml					H	FDA-EUA
<a href="#">COVID-19 RT-Digital</a>	Gnomegen	RNA		PCR	4-6	NA	NA	100%	100%	200/ml					H	FDA-EUA
<a href="#">Panther Fusion SARS CoV-2</a>	Hologic	RNA		PCR	3	NA	NA	100%	100%	0.01					H	FDA-EUA
<a href="#">Smart Detect SARS</a>	InBios Intl	RNA		PCR	4-6	NA	NA	97%	100%	1100/ml					H	FDA-EUA
<a href="#">COV-19 IDx</a>	Ipsium Dx	RNA		PCR	24					8500/ml					H	FDA-EUA
<a href="#">Curative-Korva SARS-Cov-2 Assay</a>	KorvaLabs	RNA		PCR	4-6	NA	NA	97%	100%						H	FDA-EUA
<a href="#">COV-19 RT-PCR</a>	Labcorp	RNA		PCR	24					6250/ml					H	FDA-EUA
<a href="#">LabGun COVID-19 RT-PCR Kit</a>	LabGenomics Co.	RNA		PCR						20000/ml					H	FDA-EUA
<a href="#">Aries SARS-CoV2 assay</a>	Luminex	RNA		PCR	2	NA	NA	100%	100%	1000/ml					H/M	FDA-EUA
<a href="#">NxTAG CoV Extended Panel Assay</a>	Luminex	RNA		PCR	4	NA	NA	100%	100%	5000/ml					H	FDA-EUA
<a href="#">SARS-CoV-2 Fluorescent PCR Kit</a>	Maccura Biotech	RNA		PCR	2	NA	NA	100%	97%	1000/ml					H	FDA-EUA
<a href="#">Accula SARS -CoV2 test</a>	Mesa	RNA		PCR-POC	<1					100/rx					H/M/W	FDA-EUA
<a href="#">NeuMo Dx SARS-CoV2</a>	NeuMoDx	RNA		PCR	1-2					150/ml					H/M	FDA-EUA
<a href="#">OPTI SARS-CoV-2 RT PCR Test</a>	OPTI Medical Systems	RNA		PCR						900/ml					H	FDA-EUA
<a href="#">GeneFinder COVID-19 Plus RealAmp Kit</a>	OsangHealthcare	RNA		PCR	4-6										H	FDA-EUA
<a href="#">New Coronavirus</a>	Perkin Elmer	RNA		PCR	4-6					9-30/ml					H	FDA-EUA
<a href="#">COVID19 genesis realtime PCR test</a>	Primerdesign	RNA		PCR	2	NA	NA	95%	100%	330/ml					H	FDA-EUA
<a href="#">Qiastat-Dx Respiratory</a>	Qiagen	RNA		PCR	96-120	NA	NA	100%	100%	500/ml					H/M	FDA-EUA
<a href="#">Quest SARS-CoV2 rRT-PCR</a>	Quest	RNA		PCR	1					136/ml					H	FDA-EUA
<a href="#">Lyra SARS-CoV2 assay</a>	Quidel	RNA		PCR	4-6					800/ml					H	FDA-EUA
<a href="#">Rheonix COVID-19 MDx Assay</a>	Rheonix	RNA		PCR						625/ml					H	FDA-EUA
<a href="#">Cobas SARS-CoV2</a>	Roche	RNA		PCR	3.5	100%	100%	100%	100%	150/ml					H/M	FDA-EUA
<a href="#">SARS CoV2 assay</a>	Rutgers Clinical	RNA		PCR	4-6										H	FDA-EUA
<a href="#">2019-nCoV Nucleic Acid Diagnostic Kit</a>	Sansure BioTech	RNA		PCR		NA	NA	94%	99%	200/ml					H	FDA-EUA
<a href="#">SARS-CoV RT-PCR kit</a>	ScienCell Research Labs	RNA		PCR	4-6					3162/ml					H	FDA-EUA
<a href="#">STANDARD M nCoV Real-Time Detection</a>	SD Biosensor	RNA		PCR	6					125-500/					H	FDA-EUA
<a href="#">U-TOP COVID-19 Detection Kit</a>	SEASUN BIOMATERIALS	RNA		PCR						1000/ml					H	FDA-EUA
<a href="#">Allplex 2019-nCoV</a>	Seegene	RNA		PCR	4	NA	NA	100%	97%	1250/ml					H	FDA-EUA
<a href="#">CRISPR SARS-CoV-2</a>	SHERLOCK Biosciences	RNA		CRISPR	1					900/ml					H	FDA-EUA
<a href="#">TagPath Covid-19 Combo kit</a>	Thermo Fisher	RNA	ORF1ab, S, N	PCR	4					10/ml					H	FDA-EUA
<a href="#">PhoenixDx 2019-CoV</a>	Trax Management	RNA		PCR	4-6					100/ml					H	FDA-EUA
<a href="#">NY SARS-CoV</a>	Wadsworth Center	RNA		PCR	24-72					25/ml					H	FDA-EUA
<a href="#">Quick SARS-CoV-2rRT-PCR Kit</a>	Zymo Research Corp.	RNA		PCR		NA	NA	100%	100%	83/ml					H	FDA-EUA
<a href="#">COVID-19 RT-PCR Test</a>	Baptist Hospital Miami	RNA		PCR	4-6											LDT-EUA
<a href="#">Childrens-Altona-SARS-CoV-2 Assay</a>	Boston Children's	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS CoV2 RT-PCR</a>	CHOP	RNA		PCR	4-6											LDT-EUA
<a href="#">CirrusDx SARS-CoV-2 Assay</a>	CirrusDx Laboratories	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS-CoV-2 PCR Test</a>	Diatherix Eurofins	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS-CoV-2 Test</a>	Exact Sciences	RNA		PCR	4-6											LDT-EUA
<a href="#">CDI Enhanced COVID-19 Test</a>	Hackensack University	RNA		PCR	3-5											LDT-EUA
<a href="#">Explify Respiratory</a>	IDbyDNA	RNA		NGS	4-6											LDT-EUA
<a href="#">SARS-CoV-2 Assay</a>	Integrity Laboratories	RNA		PCR	4-6											LDT-EUA
<a href="#">MGH COVID19</a>	Massachusetts General	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS-CoV-2 Molecular Detection Assay</a>	Mayo Clinic	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS CoV2 assay</a>	Northwestern Medicine	RNA		PCR	4-6											LDT-EUA
<a href="#">Orig3n 2019 nCoR (COVID-19) Test</a>	Orig3n	RNA		PCR	4-6											LDT-EUA
<a href="#">SDI SARS-CoV-2 Assay</a>	SDI Labs	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS CoV2 assay</a>	Stanford	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS-CoV-2 real-time RT-PCR test</a>	UNC Medical Center	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS CoV2 assay</a>	Viracor	RNA		PCR	4-6											LDT-EUA
<a href="#">SARS CoV2 PCR</a>	Yale	RNA		PCR	4-6											LDT-EUA

\* Mostly unreported at time of writing; will be added as information emerges. Data from publications (click sensitivity value for hyperlink), [FIND](#) or [TestingCovid](#)

## FDA cleared protein tests

Test	Company	Source	Target	Type	Time (h)	Manufacturer data					Trial data*				Use	Clearance
						Sens	Spec	PPV	NPV	LOD	Sens	Spec	PPV	NPV		
<a href="#">SARS-CoV-2 Immunoassay</a>	Abbott	Ig		CLIA	30 min	100%	100%							H/M	FDA-EUA	
<a href="#">Anti-SARS-CoV-2 Rapid Test</a>	Autobio Diagnostics	Ig		LFA	15-20 min		100%							H/M	FDA-EUA	
<a href="#">Platelia SARS-CoV-2 Total Ab test</a>	BioRAD	Ig		EIA		100%	99%	92.2%	99.6%					H	FDA-EUA	
<a href="#">qSARS-CoV-2 IgG/IgM Rapid Test Kit</a>	Cellex	Ig		LFA	<1	NA	NA	93.8%	96%					H/M	FDA-EUA	
<a href="#">DPP COVID-19 IgM/IgG System</a>	ChemBioDx Systems	Ig		LFA	<1									H/M	FDA-EUA	
<a href="#">LIAISON SARS-CoV-2 S1/S2 IgG</a>	DiaSorin Inc.	Ig		CLIA		NA	NA	98%	99%					H/M	FDA-EUA	
<a href="#">Anti-SARS-CoV-2 ELISA (IgG)</a>	EUROIMMUN US Inc.	Ig		ELISA		NA	NA	90%	100%					H	FDA-EUA	
<a href="#">COVID-19 ELISA IgG Antibody Test</a>	Mount Sinai	Ig		ELISA	<1									H	FDA-EUA	
<a href="#">VITROS Immunodiagnostic Total</a>	Ortho Clinical	Ig		ELISA	<1		100%							H/M	FDA-EUA	
<a href="#">VITROS Immunodiagnostic IgG</a>	Ortho Clinical	Ig		ELISA	<1		100%							H/M	FDA-EUA	
<a href="#">Sofia 2 SARS Antigen FIA</a>	Quidel	Antigen		FIA	15 min	80%	100%							H/M/W	FDA-EUA	
<a href="#">Elecsys Anti-SARS-CoV-2 Cobas immunoassay</a>	Roche	Ig		ECLIA	20 min	100%	99.8%							H/M	FDA-EUA	
<a href="#">NY SARS-CoV Microsphere Immunoassay</a>	Wadsworth Center	Ig		MIA		79%	97%							H	FDA-EUA	

## Abbreviations

ACE2	Angiotensin converting enzyme 2
CDC	Center for Disease control
CE Mark	European community certification
CLIA	Chemiluminescence Immunoassay
ddPCR	Digital droplet PCR
DETECTR	DNA endonuclease-targeted CRISPR transreporter
ECLIA	Electrochemiluminescence immunoassay
ECS	Electrochemical sensing
EIA	Enzyme Immunoassay
ELISA	Enzyme linked immunoabsorbent assay
EUA	Emergency Use Authorization
FDA	Federal Drug Agency

FIA	Fluorescence immunoassay
H	H - Laboratory CLIA certified
HC FL	Hybrid Capture Fluorescence Immunoassay
HR	Heart rate
IFM	Immunofluorescence microscopy
Ig	Immunoglobulin
LAMP	Loop Mediated Isothermal Amplification
LDT	Laboratory diagnostic test
LFA	Lateral flow assay
LOD	Limit of detection
M	M - Laboratory CLIA certified
MIA	Microsphere Immunoassay
NEAR	Nicking endonuclease amplification reaction
NA	Not available
NGS	Next generation sequencing
NPV	Negative predictive value
PCR	Polymerase chain reaction

PCR-POC	PCR point of care
pO2	Oxygen tension
POC	Point of care
PPV	Positive predictive value
RCA	Rolling circle amplification
RPA	Recombinase Polymerase Amplification
RR	Respiratory rate
RUO	Research use only
Sens	Sensitivity
Spec	Specificity
SHERLOCK	specific high-sensitivity enzymatic reporter unlocking CRISPR
VAT	Viral antigen test
VNT	Virus neutralization assay
W	CLIA waiver
WB	Western blot
μNMR	Micro nuclear magnetic resonance

\* Mostly unreported at time of writing; will be added as information emerges. Data from publications (click sensitivity value for hyperlink), [FIND](#) or [TestingCovid](#)