

BREATH ANALYSIS FOR COVID DIAGNOSIS – ANALYZERS

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The COVID-19 pandemic has created an urgent need for rapid, simple, inexpensive, and easily accessible testing for COVID infections. Breath analysis is an attractive prospect for large scale testing because it uses a non-invasive specimen. Table 1 summarizes the current range of breath analyzers (as of January 2021) that have been utilized for diagnosis of COVID-19 infections.

The detection technologies employed include gas chromatography, different forms of mass spectrometry, and nanosensors. In some cases, artificial intelligence (machine learning) is used as part of the analytical process. Classically, breath analysis involves analysis of specific compounds or patterns (signatures) of compounds (breathomics), however, other strategies involve the harvesting of viral particles from breath into silicon cavities and subsequent PCR (e.g., CoviDx). Ease of access to testing is a consideration for the mass testing necessitated by the pandemic, and one strategy involves the use of a kiosk to facilitate access to testing (e.g., Worlds Protect).

Table 1. Breath analyzers for COVID-19 testing.

COMPANY	ANALYZER (technology)
Ancon Technologies Ltd https://www.ancontechologies.com/	Nanotechnology Biomarker Tagging (NBT)
https://www.getsurrey.co.uk/news/surrey-news/trials-ground-breaking-10-minute-18830472 https://clinicaltrials.gov/ct2/show/NCT04459962	
Astrotech https://www.astrotechcorp.com/	BreathTest-1000™ (mass spectrometry)
https://www.healthleadersmedia.com/innovation/researchers-explore-breath-taking-possibility-rapid-low-cost-covid-19-breath-test https://www.plasmion.de/breath-analysis	
Avocado https://avokad.io/	Avocado (IOT technologies and nano-sensors)
https://avokad.io/covid-19/	
Breathonix Pte Ltd. (see also Ionicon) https://breathonix.com/	PTR-TOF 6000 X2 (Proton-transfer-reaction (PTR)-Time of Flight (TOF) Mass Spectrometry)
https://www.mobihealthnews.com/news/asia-pacific/nus-spin-company-develops-one-minute-breath-test-detect-covid-19	

BreathTech Corp https://www.breathtech.com/	
See Astrotech	
Canary Health Technologies and SmartShape Design https://www.canaryhealthtech.com/ http://smartshape.design/	ASU Detect CV19 (nanosensors and cloud-based artificial intelligence)
https://www.prnewswire.com/news-releases/ground-breaking-human-trial-for-covid-19-ultra-rapid-breath-test-begins-in-india-301187497.html	
Deep Sensing Algorithms https://dsa.fi/	DSA Analyzer (Nanosensors and Deep Sensing Algorithms)
https://dsa.fi/solutions-for-covid-19 https://forumvirium.fi/en/corona-breath-test/	
Exhalation Technology (ETL) https://www.exhalationtechnology.com	CoronaCheck™ (biosensor)
https://www.biospace.com/article/exhalation-technology-etl-announces-new-clinical-trial-for-coronacheck-a-rapid-covid-19-test-for-exhaled-breath/	
GreyScan https://greyscandetection.com/	GreyScan ETD-100
https://www.itwire.com/science/greyscan,-university-of-tasmania-collaborate-to-develop-covid-19-environment-trace-detection-tool.html	
Hoth Therapeutics Inc https://hoththerapeutics.com	On-the-Go SARS-CoV-2 Testing Device System (biosensor)
https://sciencebusiness.technewslit.com/?p=39704	
Hound Labs Inc https://houndlabs.com/	Hound COVID-19 Breathalyzer
https://www.globenewswire.com/news-release/2020/09/30/2101323/0/en/Hound-Labs-Introduces-the-HOUND-COVID-19-BREATHALYZER.html https://houndlabs.com/covid-19-research-and-testing/	
Imec https://www.imec-int.com/en	CoviDx (silicon microscale PCR cavities to capture viral particles and high-speed real-time quantitative (RT-q) PCR)
https://www.mpo-mag.com/contents/view_breaking-news/2020-10-30/imec-developing-five-minute-covid-test/	
IMSPEX http://www.imspeex.com/	BreathSpec (GC-Ion Mobility Spectrometry)
https://www.labmedica.com/molecular-diagnostics/articles/294785475/a-breath-analysis-test-for-rapid-diagnosis-of-covid-19.html	
Ionicon https://www.ionicon.com	PTR-TOF 6000 X2 (PTR-Time of Flight (TOF) Mass Spectrometry)
https://www.ionicon.com/blog/2020/covid-19-detection-in-breath	

Mercyhealth and RJ Lee Group Inc https://mercyhealthsystem.org/ https://rjlq.com/	Spectroscopic assay
https://www.nbc15.com/2020/12/12/researchers-in-janesville-say-rapid-breath-test-study-to-detect-covid-19-holds-great-promise/	
Nanoscent https://nanoscentlabs.com/	Nasal Scent Recorder (Chemiresistors and machine learning)
https://cen.acs.org/business/instrumentation/Sumitomo-funds-NanoScent-COVID-19/98/i20	
Nanose Medical https://nanosemed.com/	DiaNose (Nanomaterial-based sensors and machine learning)
https://ats.org/our-impact/breathalyzers-next-big-step-in-covid-19-testing/ https://nanosemed.com/covid-19/	
NextGen Biomed (merging with Scentech Medical) https://www.scentech-medical.com/	(Gas Chromatography-Mass Spectrometry. GC-MS)
https://www.timesofisrael.com/israeli-company-announces-identification-of-covid-19-indicators-in-breath-test/	
Ohio State University https://www.osu.edu/	Breathalyzer (semiconductor sensors)
https://news.osu.edu/ohio-state-researchers-testing-breathalyzer-to-detect-covid-19/	
Owlstone https://www.owlstonemedical.com	Breath Biopsy® [Field Asymmetric Ion Mobility Spectrometry FAIMS]
https://www.owlstonemedical.com/breath-biopsy-covid-19-research/	
Peking University https://www.pku.edu.cn/	Breath-borne VOC Biomarkers for COVID-19
https://www.medrxiv.org/content/10.1101/2020.06.21.20136523v1.article-info	
Plasmion https://www.plasmion.de	SICRIT Breath Analysis System (High-Resolution Mass Spectrometry, HRMS)
https://www.plasmion.de/breath-analysis	
RJ Lee Group Inc https://rjlq.com/	
See Mercyhealth	
Shimadzu Corporation https://www.shimadzu.com	LCMS-8060X (Mass Spectrometry)
https://www.shimadzu.com/news/vdwgz9lkhixerja.html https://www.japantimes.co.jp/news/2020/10/17/national/japan-research-coronavirus-breath-testing/	
SmartShape Design	

http://smartshape.design/	
See Canary Health Technologies	
Technion – Israel Institute of Technology https://www.technion.ac.il	
See University of Science and Technology of China	
TeraGroup https://www.tera.group	TeraSystem and TeraScanner (Terahertz waves)
https://www.forbes.com/sites/ninashapiro/2020/10/29/covid-19-breath-analyzer-being-tested-at-the-university-of-miami/?sh=3169d6e8765b https://www.iclinics.cl/wp-content/uploads/2020/10/tae-Brochure-Coronavirus-Breath-Analyzer.pdf	
University of California Los Angeles https://samueli.ucla.edu/	Breathalyzer (fluorescent genetic tags)
https://newsroom.ucla.edu/stories/ucla-team-receives-nsf-grant-to-develop-breathalyzer-like-diagnostic-test-for-covid-19	
University of Science and Technology of China and Technion – Israel Institute of Technology	Multiplexed Nanomaterial-Based Hybrid Sensor Array
https://pubs.acs.org/doi/abs/10.1021/acsnano.0c05657	
Worlds Inc. https://www.worlds.com/	“Worlds Protect” (AI and Mass Spectrometry in a kiosk)
https://theeagle.com/news/a_m/texas-a-m-system-partnership-develops-covid-19-breath-test/article_98cd7a72-2a72-11eb-a19d-27af8367f334.html https://www.bloomberg.com/press-releases/2020-03-25/astrotech-developing-screening-instrument-for-lung-diseases-including-covid-19-coronavirus-pneumonia	