



VOLATOLOMICS

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INTRODUCTION

The IFCC Emerging Technology Division (ETD) is dedicated to providing current awareness for emerging technologies likely to have important clinical diagnostic applications in the near future. One of those technologies is volatolomics (breathomics) (i.e., breath analysis).

This is the final update of the volatolomics survey [tps://www.ifcc.org/media/478026/2019-06-volatolomics.pdf](https://www.ifcc.org/media/478026/2019-06-volatolomics.pdf)) and it primarily covers the 2020 and 2021 scientific literature.

1. VOLATOLOMICS AND BREATH ANALYSIS IN THE NEWS

General

- Alan. Tech Companies Partner on Covid-19 Breath Test. 2021;Feb 25. <https://sciencebusiness.technewslit.com/?p=41050>.
- Behrends W. Breathomics: far more than hot air. Healthcare-in-Europe. 06-04-2020. <https://healthcare-in-europe.com/en/news/breathomics-far-more-than-hot-air.html>
- Ketchum K. Brown University Researchers Develop RNA- Based Breath Test for COVID-19. Genomeweb. 2021:Nov 9. <https://www.genomeweb.com/covid-19/brown-university-researchers-develop-rna-based-breath-test-covid-19#.YY1JXKB0mZw>.

Clinical

- NASDAQ Market News. Medivolve and Marvel Diagnostics Successfully Complete First Stage Clinical Testing of BlowFISH, a Non-Invasive Exhaled Breath Diagnostic Technology For COVID-19, Developed by a UCLA Research Team Led by Dr. Pirouz Kavehpour. PM360. 2021;May 5. <https://www.pm360online.com/medivolve-and-marvel-diagnostics-successfully-complete-first-stage-clinical-testing-of-blowfish-a-non-invasive-exhaled-breath-diagnostic-technology-for-covid-19-developed-by-a-ucla-research-team-led/>.



Webinars

- Focant J-F. Recent applications in volatolomics. Facebook. 2021. <https://www.facebook.com/events/belgium/recent-applications-in-volatolomics/159554082766212/>.

2. A-Z DIRECTORY OF COMPANIES ACTIVE IN THE CLINICAL DIAGNOSTIC APPLICATIONS OF VOLATOLOMICS (BREATH ANALYSIS)

- Avisa Diagnostics (<https://www.avisadx.com>)
- Breathomix (<https://www.breathomix.com/team/>)
- Medivolve Inc (<https://medivolve.ca>)

3. CLINICAL TRIALS

4. ANALYZERS AND REGULATORY APPROVALS

5. LITERATURE BY TOPIC – DIAGNOSTIC APPLICATIONS

5.1. ANALYZERS, SENSORS AND METHODS

Artificial intelligence

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- Thomas J, Roopkumar J, Patel T. Machine learning analysis of volatolomic profiles in breath can identify non-invasive biomarkers of liver disease. Res Square; 2021. doi: 10.21203/rs.3.rs-192281/v1.

Electronic nose

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Infrared

- Fufurin IL, Anfimov DR, Kareva ER, et al. Numerical techniques for infrared spectra analysis of organic and inorganic volatile compounds for biomedical applications. *Opt Eng* 2021;60:082016. <https://doi.org/10.1117/1.OE.60.8.082016>.

Mass Spectrometry

- Belluomo I, Boshier PR, Myridakis A, et al. Selected ion flow tube mass spectrometry for targeted analysis of volatile organic compounds in human breath. *Nat Protoc* 2021;16:3419-38. <https://doi.org/10.1038/s41596-021-00542-0>.
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- Marder D, Tzanani N, Baratz A, et al. A multiple-method comparative study using GC-MS, AMDIS and in-house-built software for the detection and identification of "unknown" VOC's in breath. *J Mass Spectrom* 2021;e4782. <https://doi.org/10.1002/jms.4782>.
- Pleil JD, Lowe CN, Greer MAG, William AJ. Using the US EPA CompTox Chemicals Dashboard to interpret targeted and non-targeted GC-MS analyses from human breath and other biological media. *J Breath Res* 2021;15:025001.

Nanotechnology

- Nag S, Castro M, Choudhary V, Feller J-F. Boosting selectivity and sensitivity to biomarkers of quantum resistive vapour sensors used for volatolomics with nanoarchitected carbon nanotubes or graphene platelets connected by fullerene junctions. *Chemosensors* 2021;9:66. <https://doi.org/10.3390/chemosensors9040066>.

- Naseri N, Kharraz S, Abdi K, Alizadeh R. Fabrication of an SPME fiber based on ZnO@GA nanorods coated onto fused silica as a highly efficient absorbent for the analysis of cancer VOCs in water and urine. *Anal Chim Acta* 2021;338983. <https://doi.org/10.1016/j.aca.2021.338983>.
- Zhou Y, Zhang Y, Xue C, et al. Hydrochromic Ni₂(CH₃)₄NI derived humidity self-adaptive nano-electronic for precisely tracking gastric cancer-related volatile markers under humid condition. *Chem Eng J* 2021;425:130543. <https://doi.org/10.1016/j.cej.2021.130543>.

Sensor array

- Mougang YK, Di Zazzo L, Minieri M, et al. Sensor array and gas chromatographic detection of the blood serum volatolomic signature of COVID-19. *iScience* 2021;24:102851. <https://doi.org/10.1016/j.isci.2021.102851>.
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5.2. APPLICATIONS

Ageing

- Sukul P, Grzegorzewski S, Broderius C, et al. Breathomics of healthy female aging: Physio-metabolic effects of puberty, teenage, reproductive and postmenopausal life on exhaled biomarkers. <https://ssrn.com/abstract=3872038> or <http://dx.doi.org/10.2139/ssrn.3872038>.

Animal Studies

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Asthma

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Autoimmune disease

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Cancer

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Breast cancer

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Gastric cancer

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Lung cancer

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Mesothelioma

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Oral cancer

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Prostate cancer

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Cystic Fibrosis

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Diabetes

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Ethanol

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Exercise

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Heart Failure

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Infectious Diseases

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COVID-19

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Malaria

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Kidney

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Liver Disease

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Metabolic disease

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Parkinson's Disease

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Pulmonary Disease

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Chronic Obstructive Pulmonary Disease (COPD)

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Stress

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5.3. PRACTICE GUIDELINE

5.4. REVIEWS, BOOKS & OPINIONS

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5.5. SPECIMENS, COLLECTION AND SAMPLING

Confounding factors

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