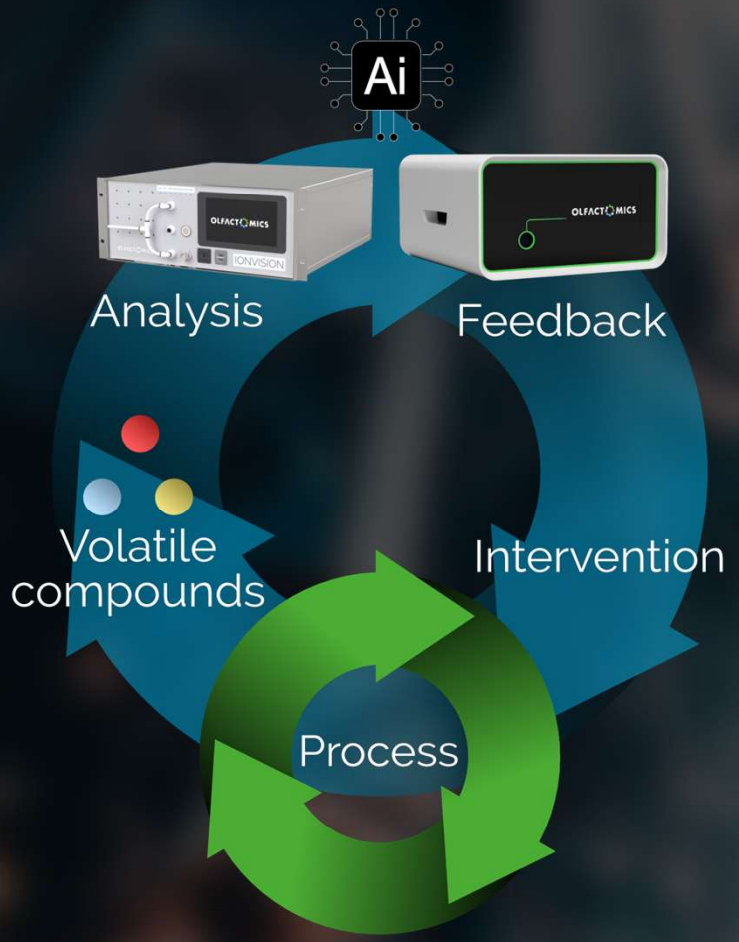

OLFACTOMICS
On SME-University collaboration

Olfactomics enables online molecular analysis of medical procedures and industrial processes



WE ARE

Two surgeons thinking outside the box

top DMS experts

legal and financial professionals

Antti Roine, MD, PhD
CEO / co-founder

Surgeon-in-training turned entrepreneur since 2014
All-around medtech player with experience from research, quality and healthcare digitalization

Niku Oksala, MD, PhD
CMO / Chairman of the board / co-founder

Professor of surgery at Tampere University
Has held positions in pharma, medtech startups and consulted a number of tech companies

Anton Kontunen, DSc
COO / partner

A decade of hands-on experience of applying DMS in industrial and medical problems

Osmo Anttalainen
CTO / partner
Top expert in DMS technology
Has designed and built sensors for defence and space applications for several decades

Petteri Tenhunen
CLO / Board member / co-founder
15+ years of experience in startups and life science field

Riku Oksala
CFO / Board member / co-founder
Experience from Nasdaq, managerial positions in several companies

Management team is supported by a brilliant team of engineers. We are headquartered in Tampere, Finland.

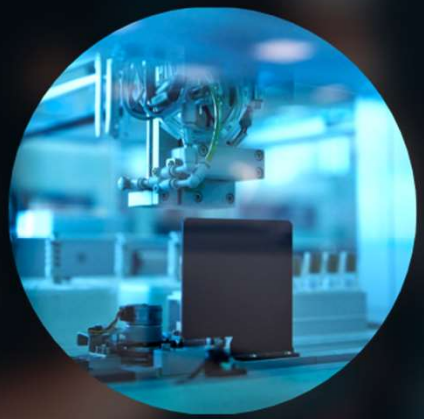
DIFFERENTIAL MOBILITY SPECTROMETRY

Gas detection technology developed to protect soldiers from chemical warfare agents.

Routinely used in airport security to detect traces of explosives.

High sensitivity and reliability have sent the technology to the International Space Station.

Used in pharma and analytical chemistry as a prefilter for mass spectrometers.



OLFACTOMICS

Olfactomics brings next-generation DMS to novel industrial and medical applications.

PRODUCT PORTFOLIO

Two systems built around modular differential mobility spectrometry technology

RESECT

Class C IVD medical device that enables more accurate cancer surgery.

IONVISION

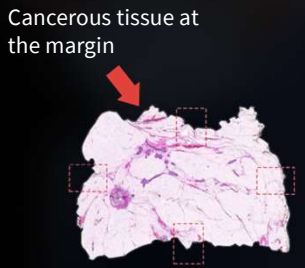
Modular gas sensor with cloud software for research and industrial quality control.

RESECT

Revolutionary surgical margin assessment

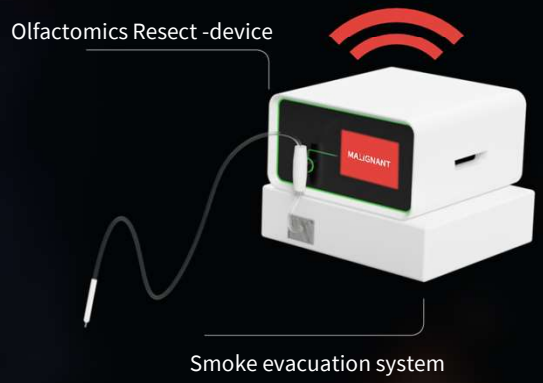
THE PROBLEM

Every fifth cancer is removed incompletely in the first surgery



Current methods for margin assessment are expensive, slow or unreliable

THE SOLUTION



Olfactomics Resect assesses the margins as the surgeon operates by analyzing surgical smoke with DMS

VALUE

HEALTHCARE PROVIDER:

Savings from reduced reoperations and complications

THE PATIENT:

Better functional and cosmetic outcomes

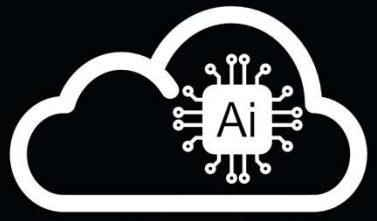
IONVISION

Industrial gas analytics platform

REPROGRAMMABLE HARDWARE

FPGA-accelerated reprogrammable DMS sensor enables detection of multiple gases without hardware changes

CLOUD ANALYTICS



Cloud platform allows decentralized data-analytics and reduces the need for inhouse analysts for the customer

APPLICATION SPECIFIC PERIPHERALS

Olfactomics develops custom sampling solutions for the customer in project-basis

Applications

LIFE SCIENCE

Detection of medical conditions from compounds released by humans or other organisms

FUEL

Detection of key indicator of product quality and process health in fossil and renewable fuel.

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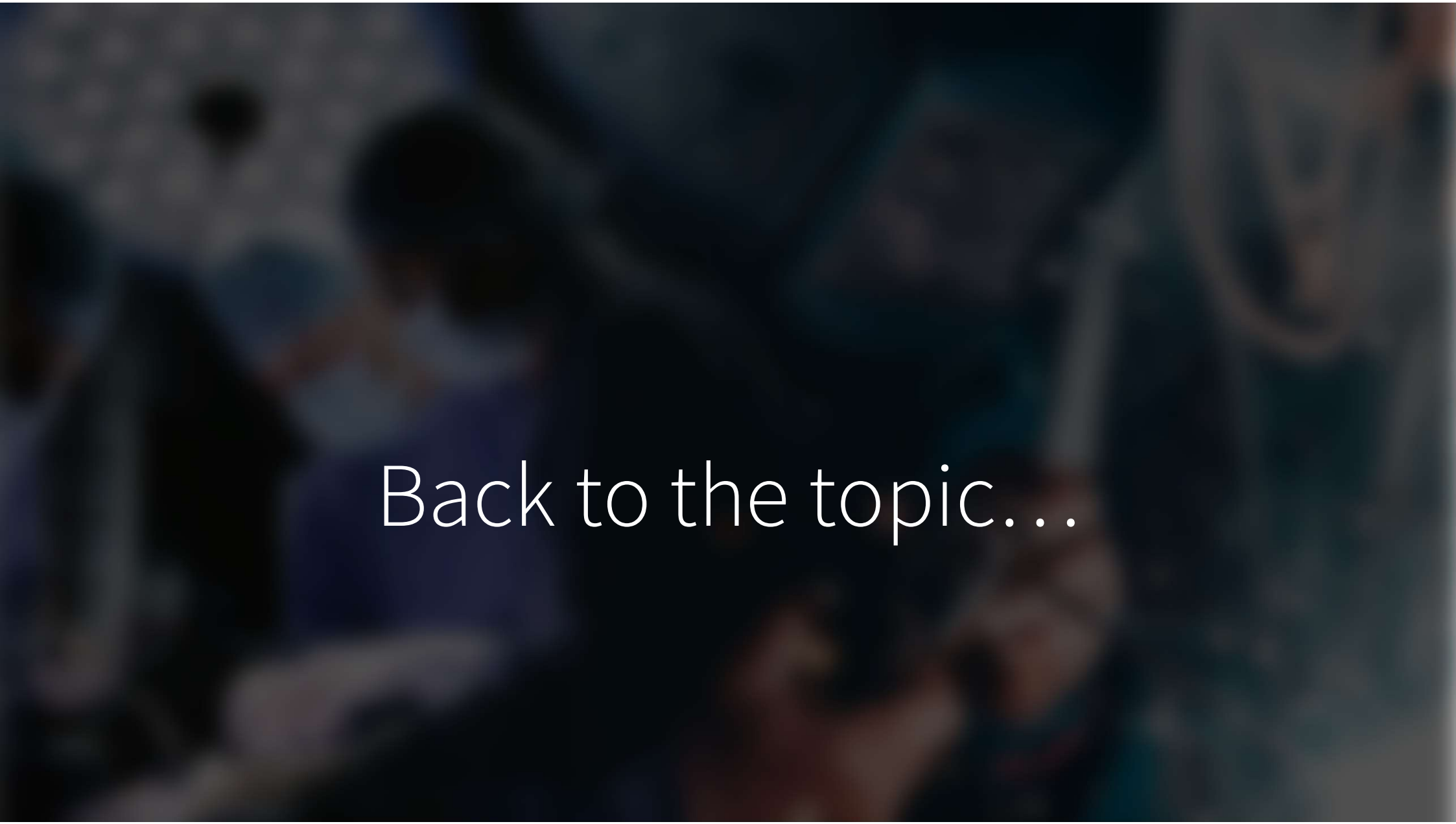
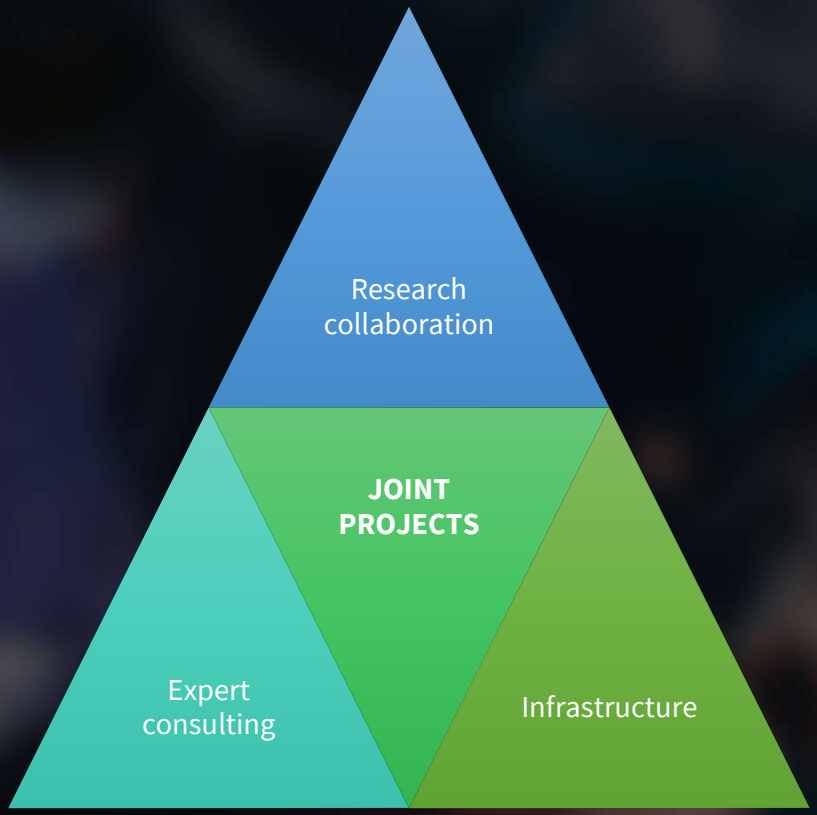
ENERGY STORAGE

Detection of leaking Li-Ion batteries in various stages of battery value chain.

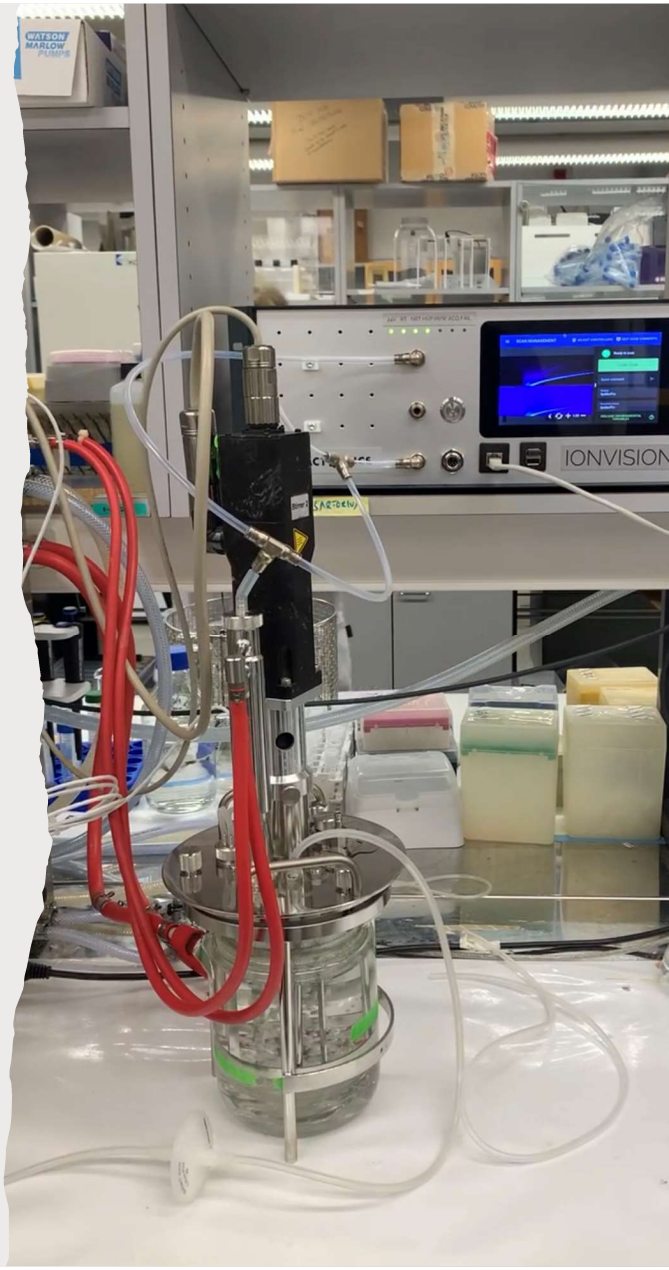

Back to the topic…

Our collaboration with TUNI



JOINT PROJECTS

- ATTRACT (EU H2020)
  - Jointly applied for development of novel laser-based sampling system with TUNI team (Antti Vehkaoja)
  - Solution still in use
  - Several publications
  - Lean R&D platform for us
- SynBioPro (BF)
  - In-Kind collaboration to pilot Olfactomics IonVision in synthetic biology
  - Successful pilot done with TUNI synthetic biology (Ville Santala)
- E3 (BF)
  - In-Kind collaboration to test the system in detection of viral infection with
  - Test conducted at Helsinki University, TUNI aerosol physics team provides gold standard reference to Olfactomics IonVision

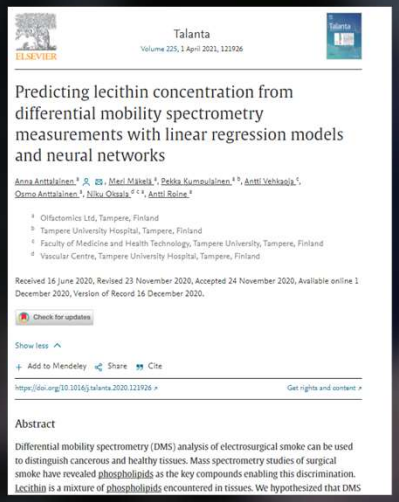


Expert consulting / infrastructure

- Olfactomics constantly tries innovative approaches to customer problems → need for instrumentation
  - A case of microlaser drilling
- PCB design work and reviews purchases from TUNI on contract basis
- TUNI Fablab services utilized for rapid prototyping of mechanical components
- Olfactomics rents lab spaces from TUNI (to stay close to excellent research infrastructure)

Research collaboration

- We strongly believe that successful long-term business is based on solid science
- 10+ peer-reviewed joint articles



Talanta
Volume 225, 1 April 2021, 121926

Predicting lecithin concentration from differential mobility spectrometry measurements with linear regression models and neural networks

Anna Anttalainen [a], Meri Mäkelä [a], Pekka Kumpulainen [a, b], Antti Vehkaoja [c], Osmo Anttalainen [a], Niku Oksala [d, e, a], Antti Roine [a]

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Received 16 June 2020, Revised 23 November 2020, Accepted 24 November 2020, Available online 1 December 2020, Version of Record 16 December 2020.

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https://doi.org/10.1016/j.talanta.2020.121926

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Abstract

Differential mobility spectrometry (DMS) analysis of electrosurgical smoke can be used to distinguish cancerous and healthy tissues. Mass spectrometry studies of surgical smoke have revealed phospholipids as the key compounds enabling this discrimination. Lecithin is a mixture of phospholipids encountered in tissues. We hypothesized that DMS

Experimental and Molecular Pathology 125 (2022) 104759

Contents lists available at ScienceDirect

Experimental and Molecular Pathology

journal homepage: www.elsevier.com/locate/yexmp

Laser desorption tissue imaging with Differential Mobility Spectrometry

Maiju Lepomäki [a,d,*], Anna Anttalainen [b,c], Artturi Vuorinen [c], Teemu Tolonen [d], Anton Kontunen [b,c], Markus Karjalainen [b,c], Antti Vehkaoja [c], Antti Roine [b,c], Niku Oksala [a,b,e]

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ARTICLE INFO

Keywords:
Differential Mobility Spectrometry (DMS)
Field asymmetric ion mobility spectrometry (FAIMS)
Tissue imaging
Tissue mapping
Breast cancer

ABSTRACT

Pathological gross examination of breast carcinoma samples is sometimes laborious. A tissue pre-mapping method could indicate neoplastic areas to the pathologist and enable focused sampling. Differential Mobility Spectrometry (DMS) is a rapid and affordable technology for complex gas mixture analysis. We present an automated tissue laser analysis system for imaging approaches (IATLAS), which utilizes a computer-controlled laser evaporator unit coupled with a DMS gas analyzer. The system is demonstrated in the classification of porcine tissue samples and three human breast carcinomas. Tissue samples from eighteen landrace pigs were classified with the system based on a pre-designed matrix (spatial resolution 1–3 mm). The smoke samples were analyzed with DMS, and tissue classification was performed with several machine learning approaches. Porcine skeletal muscle ($n = 1030$), adipose tissue ($n = 1329$), normal breast tissue ($n = 258$), bone ($n = 680$), and liver ($n = 264$) were identified with 86% cross-validation (CV) accuracy with a convolutional neural network (CNN) model. Further, a panel tissue that comprised all five tissue types was applied as an independent validation dataset. In this test, 82% classification accuracy with CNN was achieved. An analogous procedure was applied to demonstrate the feasibility of IATLAS in breast cancer imaging according to 1) macroscopically and 2) microscopically annotated data with 10-fold CV and SVM (radial kernel). We reached a classification accuracy of 94%, specificity of 94%, and sensitivity of 93% with the macroscopically annotated data from three breast cancer specimens. The microscopic annotation was applicable to two specimens. For the first specimen, the classification accuracy was 84% (specificity 88% and sensitivity 77%). For the second, the classification accuracy was 72% (specificity 88% and sensitivity 24%). This study presents a promising method for automated tissue imaging in an animal model and lays foundation for breast cancer imaging.

Annals of Otology, Rhinology & Laryngology
OnlineFirst, January 24, 2023
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https://doi.org/10.1177/00034894231151301

SAGE journals

Original Article

The Detection of Bacteria in the Maxillary Sinus Secretion of Patients With Acute Rhinosinusitis Using an Electronic Nose: A Pilot Study

Jussi Virtanen, MD [1,2], Antti Roine, MD, PhD [3,4], Anton Kontunen, DSc [2,4], Markus Karjalainen, MSc [2,4], Jura Numminen, MD, PhD [1], Niku Oksala, MD, PhD, DSc (Med) [2,4,5], Markus Rautiainen, MD, PhD [1,2], and Ilkka Kivekäs, MD, PhD [1,2]

Objective: Detecting bacteria as a causative pathogen of acute rhinosinusitis (ARS) is a challenging task. Electronic nose technology is a novel method for detecting volatile organic compounds (VOCs) that has also been studied in association with the detection of several diseases. The aim of this pilot study was to analyze maxillary sinus secretion with differential mobility spectrometry (DMS) and to determine whether the secretion demonstrates a different VOC profile when bacteria are present.

Methods: Adult patients with ARS symptoms were examined. Maxillary sinus contents were aspirated for bacterial culture and DMS analysis. *k*-Nearest neighbor and linear discriminant analysis were used to classify samples as positive or negative, using bacterial cultures as a reference.

Results: A total of 26 samples from 15 patients were obtained. After leave-one-out cross-validation, *k*-nearest neighbor produced accuracy of 85%, sensitivity of 67%, specificity of 94%, positive predictive value of 86%, and negative predictive value of 84%.

Conclusions: The results of this pilot study suggest that bacterial positive and bacterial negative sinus secretion release different VOCs and that DMS has the potential to detect them. However, as the results are based on limited data, further conclusions cannot be made. DMS is a novel method in disease diagnostics and future studies should examine whether the method can detect bacterial ARS by analyzing exhaled air.

Keywords
maxillary sinusitis, electronic nose, ion mobility spectrometry

Current Oncology

MDPI

Communication

Method for the Intraoperative Detection of IDH Mutation in Gliomas with Differential Mobility Spectrometry

Ilkka Haapala [1,*], Anton Kondratev [2], Antti Roine [2,3], Meri Mäkelä [2,3], Anton Kontunen [2,3], Markus Karjalainen [2,3], Aki Laakso [4], Päivi Koroknay-Pál [4], Kristiina Nordfors [5], Hannu Haapasalo [6], Niku Oksala [2,3], Antti Vehkaoja [2] and Joonas Haapasalo [1]

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Citation: Haapala, I.; Kondratev, A.; Roine, A.; Mäkelä, M.; Kontunen, A.; Karjalainen, M.; Laakso, A.; Koroknay-Pál, P.; Nordfors, K.; Haapasalo, H.; et al. Method for the Intraoperative Detection of IDH Mutation in Gliomas with Differential Mobility Spectrometry. *Curr. Oncol.* **2022**, *29*, 3252–3256. https://doi.org/10.3390/curroncol29050265

Received: 21 February 2022
Accepted: 29 April 2022
Published: 4 May 2022

Publisher's Note: MDPI stays neutral

Abstract: Isocitrate dehydrogenase (IDH) mutation status is an important factor for surgical decision-making: patients with IDH-mutated tumors are more likely to have a good long-term prognosis, and thus favor aggressive resection with more survival benefit to gain. Patients with IDH wild-type tumors have generally poorer prognosis and, therefore, conservative resection to avoid neurological deficit is favored. Current histopathological analysis with frozen sections is unable to identify IDH mutation status intraoperatively, and more advanced methods are therefore needed. We examined a novel method suitable for intraoperative IDH mutation identification that is based on the differential mobility spectrometry (DMS) analysis of the tumor. We prospectively obtained tumor samples from 22 patients, including 11 IDH-mutated and 11 IDH wild-type tumors. The tumors were cut in 88 smaller specimens that were analyzed with DMS. With a linear discriminant analysis (LDA) algorithm, the DMS was able to classify tumor samples with 86% classification accuracy, 86% sensitivity, and 85% specificity. Our results show that DMS is able to differentiate IDH-mutated and IDH wild-type tumors with good accuracy in a setting suitable for intraoperative use, which makes it a promising novel solution for neurosurgical practice.

Keywords: differential mobility spectrometry; neuro-oncology; neurosurgery; glioma; classification; isocitrate dehydrogenase (IDH)

Take-home message

- Agile and wide collaboration with TUNI continues to be paramount in the journey of Olfactomics!

- Universities have tredenmous brain capital and top-notch instrumentation but the ”marketing & sales” is still lagging.
- Best results are made with in long-term collaboration

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