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Your guide to laboratory and pathology equipment in Europe

LAB BOOK

2024 / 2025

Vol. 11

- Sample Processing
- Chemistry & Immunochemistry
- Hematology
- Pathology
- DNA
- Microbiology
- POCT
- Information Technology
- Other Applications



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Dear reader,

as we reflect on 2024, the field of laboratory medical devices has experienced remarkable transformation, driven by both cutting-edge innovation and essential regulatory shifts. MedTech achieved its sixth consecutive year of uninterrupted revenue growth and has now become a \$587 billion industry.

This year, advancements in diagnostic technology and automation continue to redefine what is possible in medical laboratories worldwide, yet these innovations also bring to light new challenges in balancing efficiency, accuracy, and safety.

From automated sample preparation to high-throughput analyzers, laboratories are now able to process data faster than ever, a boon for precision diagnostics and personalized medicine. Artificial intelligence and machine learning have also found their way into lab tech, helping labs analyze vast amounts of data to identify patterns that can lead to earlier, more accurate diagnoses.

The LABBook 2024/2025 celebrates these advances by highlighting both innovative products and insightful feature articles that explore the latest trends shaping our industry. From state-of-the-art equipment to everyday solutions, this year's LABBook showcases tools and technologies that support efficient workflows, improve accuracy, and enhance safety within the laboratory. These innovations are designed not only to streamline operations but also to build the foundation for a resilient future, capable of facing whatever challenges lie ahead.

Join us in exploring these exciting developments and the products that are reshaping the future of laboratory medicine.

Warm regards

A handwritten signature in black ink, appearing to read 'Tim Hofmann'.

Tim Hofmann
Specialist editor healthcare

Products & Systems

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Sample Processing

Sample Processing



NGNY
DEVICES

Sample Processing

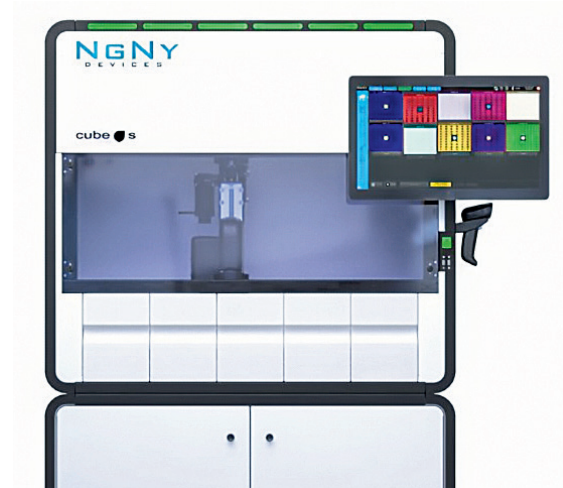
NGNY Devices – CUBE Benchtop Rack to Rack Sorter – 2nd generation

Cost-efficient workhorse:

- Registration, sorting and archiving from/to analyzer racks & centrifuge buckets
- Up to 700 tubes/hr on 1sqm
- Proven and robust design

Smart sample flow manager:

- No more tube hunting: continuous tracking and routing of tubes based on pending tests and priority
- Single-tube traceability for safe archiving
- Easy change between different workflow configurations
- Maximizing the efficiency of your LIS and middleware with dual connection and highly developed software



Sample Processing

T&O LabSystems – ATRAS Bulk Loader and Bulk/Rack Sorter – 4th generation



Highlights:

Cut down your process time, simplify your daily life and configure the ATRAS to fit your needs.

- Cost-efficient registration and sorting of bulk material
- Numerous output configurations for sorting into bulk bins, customer-specific racks and centrifuge buckets
- Fast bulk-to-rack sorting on a small footprint (3000 samples / h on 1.2 m²)
- Extendable by our intelligent sample transportation system InTrac

Equip the ATRAS according to your requirements

Features such as CapIdent, STAT Input, SIQ bin, Piston detection, Spin Check and Barcode alignment.

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Chemistry & Immunochemistry

Mass Spectrometry



Mass Spectrometry

Shimadzu – CLAM-2040 CL (IVD) / CLAM-2040 (RUO)

Dimensions:

670 × 700 × 1190 mm (w × d × h)

Weight:

185 kg

Assays:

Immunosuppressants, vitamin D, steroids, antiepileptics, antiarrhythmics drugs, amiodarone, drugs of abuse, antidepressants, neuroleptics

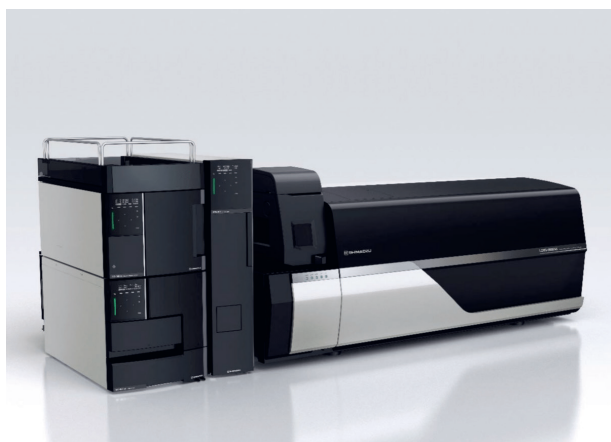


Highlights:

CLAM-2040 provides users seamless integration of automated sample preparation with LC-MS/MS to improve data quality, sample throughput, laboratory efficiency and safety. Simple workflows allow users to go from blood collection tubes to results without any additional sample handling. Each sample is processed successively in parallel, to optimize instrument usage. Easy to access software for management of reagents, calibration curves, control samples and maintenance ensure reliability and quality of results.

Mass Spectrometry

Shimadzu – LCMS-8060NX CL (IVD) / LCMS-8060 NX (RUO)



Dimensions: 1180 × 540 × 610 mm (w × d × h)

Weight: 140 kg

Highlights: The LCMS-8060NX delivers high sensitivity and ultra fast analysis speed together with robustness and high flexibility. Developed on the base of the LCMS-8060, it incorporates a newly designed ion source IonFocus to boost ion transfer to the mass spectrometer and increase even more the robustness of the system for complex biological matrices in daily analysis. The system perfectly suits to high sensitivity applications like steroids, catecholamines, and metabolomics studies in clinical research.

Mass Spectrometry

Shimadzu – LCMS-8060 CL (IVD) / LCMS-8060 (RUO)



Dimensions: 1180 × 540 × 610 mm (w × d × h)

Weight: 140 kg

Highlights: The LCMS-8060 CL delivers the highest sensitivity and fastest analysis speed of any LCMS on the market today. A newly developed UF-Qarray boosts ion intensity but suppresses noise. By improving the ion sampling device, the ion guide, and vacuum efficiency, Shimadzu has achieved an unprecedented sensitivity in quantitative analysis by LC/MS/MS while keeping high robustness for daily analysis.

Mass Spectrometry

Shimadzu – LCMS-8050 CL (IVD) / LCMS-8050 (RUO)



Dimensions: 1180 × 540 × 610 mm (w × d × h)

Weight: 140 kg

Highlights: Triple Quadrupole Mass Spectrometry is the method of choice for quantification of trace-level analytes in complex samples for a variety of applications including clinical research, forensic, toxicology, pharmacokinetics. Combined with our world-leading UHPLC systems, and maintaining Shimadzu's proprietary ultrafast technologies (UFMS), which include high-speed MRM transitions, MS/MS acquisition, and ultra-high speed polarity switching, the LCMS-8050 can dramatically improve analytical throughput.

Mass Spectrometry

Shimadzu – LCMS-8045 CL (IVD) / LCMS-8045 (RUO)



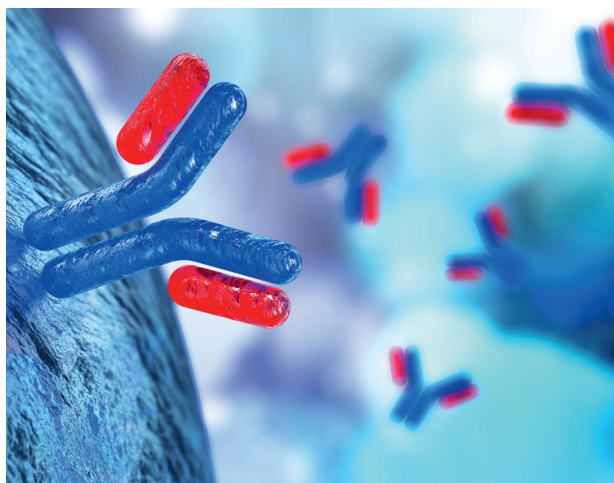
Dimensions: 1180 × 540 × 610 mm (w × d × h)

Weight: 140 kg

Highlights: The LCMS-8045 offers the proven high sensitivity, high speed and robustness of Shimadzu's UFMS series to provide highly reliable data for applications that demand the sensitivity and speed of a mass spectrometer, such as for simultaneous analysis used in the clinical research field. Due to the heated-ESI probe and UFSweeper II collision cell, it offers the highest sensitivity in the middle-range class (UFSensitivity).

Mass Spectrometry

Shimadzu – nSMOL Antibody BA Kit



Assays: 100

Highlights: nSMOL is a proprietary, innovative technique from Shimadzu, enabling selective proteolysis of the Fab region of monoclonal antibodies. The nSMOL Antibody BA Kit is a ready-to-use reagent kit for collecting monoclonal antibodies from blood or other biological samples using immunoglobulin collection resin, and then performing selective proteolysis of the Fab region of these antibodies via FG beads Trypsin DART. Fab-derived peptide fragments produced by limited digestion can then be quantified via LC-MS/MS.

Electrophoresis / Chromatography

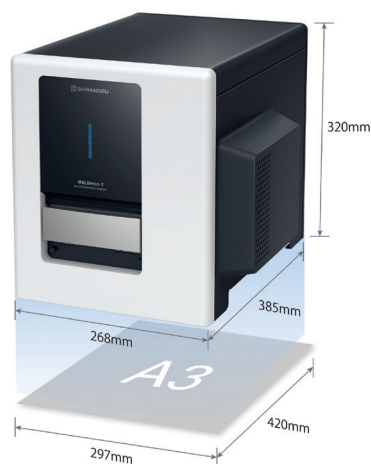
Shimadzu – HPLC/UHPLC (RUO or CE-IVD)



Highlights: Shimadzu is offering a wide range of solutions in liquid chromatography starting from standard HPLC systems to high end UHPLC systems including compact configurations. Available with several options for columns switching, pre-concentration, online SPE, etc, the systems are also well recognized for coupling with highly sensitive detectors like fluorescence, radio-activity, electrochemical, or mass spectrometry. To increase throughput with mass spectrometers, Shimadzu offers the Nexera-MX configuration.

Research Use Only

Shimadzu – MALDImini-1



Dimensions: 309 × 385 × 320 mm (w × d × h)

Weight: 25 kg

Highlights: With its simple configuration and compact size, it is possible to install the MALDImini-1 in places where mass analysis devices could not previously be used. Through ingenious engineering and innovation its footprint has been reduced to the size of a piece of paper. The MALDImini-1, with its MS3 capabilities, can be used in research facilities, educational organizations and private structures involved in biomedical science or which carry out research on the structure of glycans.

LABBOOK 2024

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Brain cancer immunotherapy

CAR-T Cells vs. Glioblastoma

Glioblastoma is the most common and most aggressive primary brain tumour, with an average survival after diagnosis of less than two years, and against which current treatments remain ineffective.

Report: University of Geneva

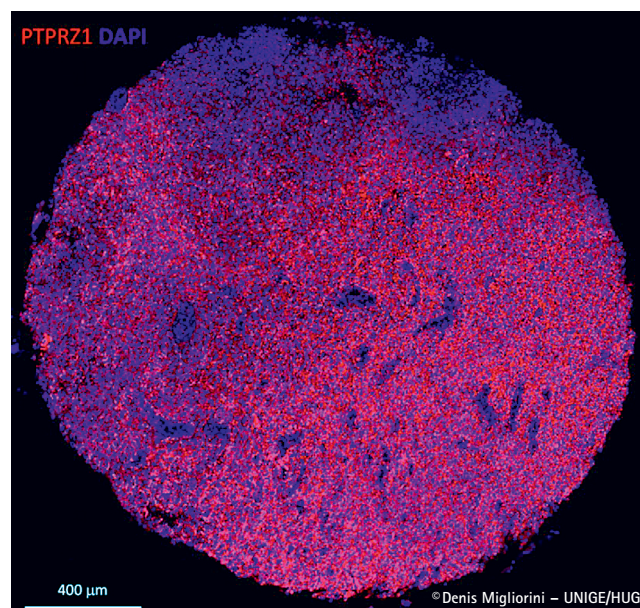
Recent advances in immunotherapy are promising, but success has been relatively modest. A team from the University of Geneva (UNIGE) and the Geneva University Hospitals (HUG) identified a marker on the surface of tumour cells, and generated CAR-T immune cells carrying an antibody to destroy them. Furthermore, these cells seem capable of targeting diseased tumour cells that do not carry this antigen, while sparing healthy cells. These results, published in *Cancer Immunology Research*, are a first step towards clinical trials with human patients.

Glioblastomas carry biological characteristics that make them particularly difficult to treat. Able to induce a microenvironment that limits the attack of the immune system, they escape standard treatments and recur rapidly.

Denis Migliorini, assistant professor in the Department of Medicine at the UNIGE Faculty of Medicine, is an expert in CAR-T cells (for chimeric antigen receptors T-cells). This immunotherapy consists in collecting immune T cells from patients, modifying them genetically in the lab to make them express antibodies capable of detecting elements specific to tumour cells, before reinjecting them so that they can specifically target the tumour.

"For several years we have been trying to identify the protein markers expressed by glioblastoma cells," explains Denis Migliorini. "One of these markers, PTPRZ1, proved particularly important: we were able to generate CAR-T cells carrying antibodies targeting PTPRZ1. This is a first step towards CAR-T cells effective against malignant gliomas."

Most CAR-T cells are generated using viral vectors, a technique that has proved its worth in certain diseases but is not very suitable in the brain. "Indeed, they persist for a very long time in the context blood cancers. The brain is a fragile organ, and this persistence can generate a risk of toxicity," explains Darel Martinez Bedoya, a post-doctoral fellow in Denis Migliorini's laboratory and first author of this research. The scientists therefore introduced in the T-cells the messenger RNA encoding for the desired antibody. The cellular machinery is then responsible for producing the right protein to build the receptor that will take place on the T-cell surface and recognise the tumour target.



Immunofluorescence staining of a representative human glioblastoma tissue section. In red, the PTPRZ1 markers, and in blue, the cell nuclei. (scale bar: 400 μ m).

"This technique has a number of advantages: CAR-Ts offer a flexible platform, allowing multiple adaptations according to the specificities and evolution of the tumour," explains Darel Martinez Bedoya.

To check that CAR-Ts only attack tumour cells, the Geneva team first tested them *in vitro* on healthy and tumour cells. "To our surprise, not only did CAR-Ts not attack healthy cells, but they were also capable, by bystander effect, of identifying and fighting tumour cells not expressing the PTPRZ1 marker," Denis Migliorini is delighted to report. "In this context, CAR-Ts are probably capable of secreting pro-inflammatory molecules that are responsible for eliminating tumour cells even in the absence of the original marker when co-cultured with target positive tumour cells."

The second stage involved testing the treatment *in vivo* in mouse models of human glioblastoma. Tumour growth was controlled, prolonging the lives of the mice remarkably well without signs of toxicity. "By administering CAR-Ts intratumorally in the CNS, we can use fewer cells and greatly reduce the risk of peripheral toxicity. With this data and other unpublished yet, all lights are green to now envisage a first clinical trial in humans," the scientists conclude.

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Next-generation pathology

Multiplexed staining techniques in the fight against complex diseases

Bringing digital pathology together with novel multiplexed staining techniques may answer key questions about complex diseases. Pathologist Lukas Marcelis, MD, PhD, believes such combinations of technology will have benefits for clinicians and patients and can help unravel some of the mysteries surrounding a range of conditions.

Report: Mark Nicholls

In one example, he believes it could explain why younger patients with Epstein-Barr Virus-positive diffuse large B-cell lymphoma NOS (EBV+ DLBCL, NOC) generally fare better than older people. Marcelis discusses these technological advances in his presentation to the 35th European Congress of Pathology in Dublin entitled "Next-generation pathology using multiplexed immunohistochemistry in haematological malignancy."

MILAN gives better context

A medical physician and trainee pathologist at University Hospitals Leuven in Belgium, having completed his PhD in EBV-driven lymphomas, he is continuing research into new multiplexed stain technologies. Speaking ahead of his presentation, he believes next-generation pathology using digital images analysis will offer significant benefits.

In a transition that sees pathologists no longer reading slides with their eyes but using computer digital image analysis, he points to the importance of correcting artefacts, and good quality control. 'One advantage is that you can identify very specific immune cell subtypes, with spatial context,' he added. With multiplexed immunohistochemistry allowing for significantly more markers on a slide (each cell can have 50+ markers), he has embraced the MILAN (multiple iterative labelling through antibody neodeposition) technique which uses immunofluorescent markers.

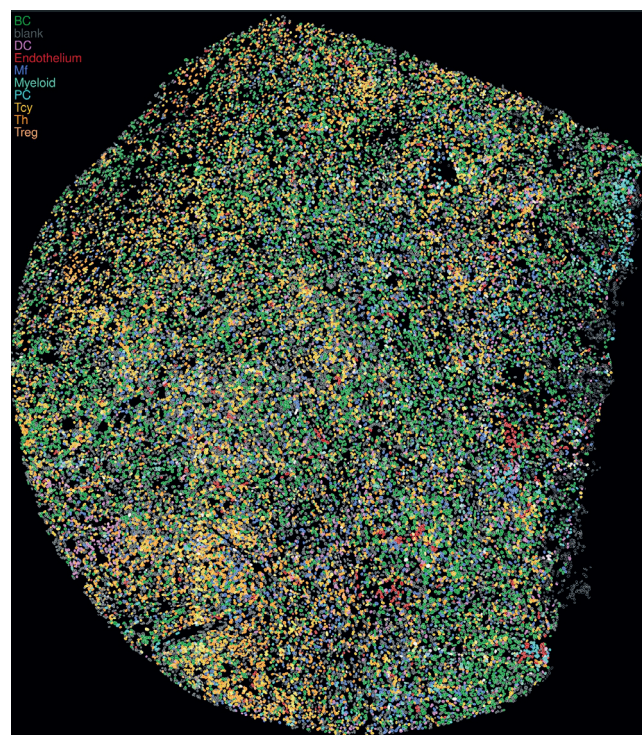
Potential in EBV-driven lymphomas

In haematological malignancy, he notes this is of particular interest in his research area of EBV-driven lymphomas, which can arise in immune-compromised patients, such as those receiving immune suppression to prevent organ rejection post-transplantation. He said: 'One question is why some develop EBV-driven lymphoproliferative disorders (EBV-driven LPD) and others do not, and why sometimes if we reduce immunosuppression the disease disappears and sometimes not.'

'In EBV-driven LPD there is a lot of interaction between immune cells, the virus and the malignancy itself which requires a multitude of antibody stains to adequately characterize.' The technique may help in predicting why in some, mainly younger, patients the immune system can control the condition better than in older people, for example.

Introduction into clinical practice almost within reach

A possible advantage for patients, he added, is that the microenvironment can be more fully characterized. This is currently highly interesting in research settings but while there is still much work to be done, he believes there is potential for this to be implemented into future clinical practice. Questions,



Digital tissue reconstruction of a DLBCL biopsy (tissue micro array core) stained using MILAN. BC: B-cell, DC: dendritic cell, Mf: macrophage, PC: plasma cell, Tcy: cytotoxic T cell, Th: helper T cell, Treg: regulatory T cell.

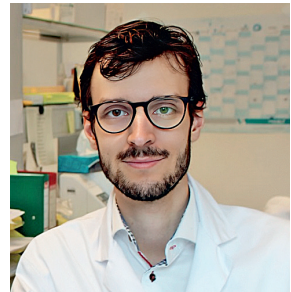
however, remain around quality control, guidelines agreement and image quality.

For example, he stressed the importance of the machine adequately recognising individual cells and avoiding over-segmenting and splitting up one cell into different parts, or under-segmenting and grouping cells together. 'Many different methods for cell segmentation exist, but for clinical practise a consensus on "gold standards" would be needed,' he said. 'But there is definitely a future in this digital image analysis using high-multiplexed stains because it can give a lot of information that cannot be obtained with classic immunochemistry.'

New answers (that will lead to new questions)

Dr Marcelis suggests there are benefits on a therapeutic and diagnostic level, such as in helping identify immune microenvironment "state" of the patient to predict the behaviour of EBV-driven LPDs or potential therapeutic options. 'Next-generation pathology and digital image analysis and multiplex will allow to identify complex immune cell types in a spatial context and do neighbourhood analysis, all things not possible with traditional immunochemistry or flow cytometry.' The big step is looking at a combination of 50-plus markers digitally on a single slide rather than through a microscope and examining and interpreting the slide differently. 'Many questions will need to be answered,' he said, 'since these techniques often identify new immune cell

clusters where we do not always know enough to name these cell types and if they are genuine or an artefact. But the future is that we are going to work more and more digitally and will have to use these techniques since they will have advantages for patients,' he concluded.



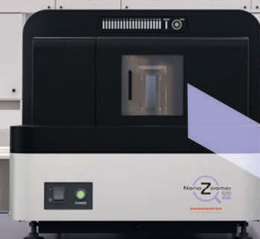
PROFILE

Lukas Marcelis, MD, PhD, is a pathologist from the Department of Pathology at University Hospitals, Leuven, Belgium, having completed his medical training at the University of Leuven and obtained his PhD in the field of biomedical sciences on Epstein-Barr Virus-driven lymphoma. His research focus is on multiplexed stain technologies in haematological malignancy. A winner of the international David Y Mason award as a promising young researcher in the field of hematopathology, he is a co-founding member and secretary of the Young European Association for Haematopathology (Young EA4HP).



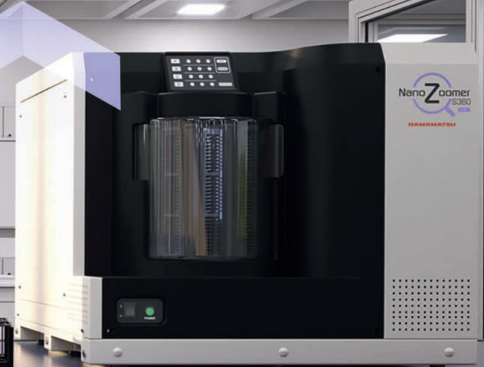
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NanoZoomer® S20MD

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Histology Equipment



Histology Equipment

KABE Labortechnik – Consumables for pathology / histology



Highlights:

- Tissue embedding cassettes
- Different variants: standard, universal, biopsy, bionet and each type also for laser printers
- Available in different colours
- Without, with separate or with pre-attached hinged lid
- Available pre-stacked: ready for use in cassette printers
- High quality material is resistant to solvents, guarantees dimensional stability and offers good writing and printability
- Comprehensive range of accessories
- Paraffin

Histology Equipment

KABE Labortechnik – Consumables for Pathology/Histology



Highlights:

- Test tubes for pathology and histology in various dimensions
 - Prefilled with 4 % formaldehyde solution
 - Screw caps for absolute leak-tightness
 - Tubes available with (individual) label with/without barcode and tear-off label
 - Untreated tubes with enclosed lid also available
- Furthermore: precise filling of customers' reagents possible on in-house filling-systems

Study

First test for the early detection of head and neck cancer being developed

Most head and neck tumors are discovered in late due in part to the fact that there is no established method for early detection. To close this gap, a team at oncnostics, a biotechnology company based in Jena, Germany, is participating in a study which aims to develop an early detection test.

Report: Sonja Buske

In Germany alone, every year 17,000 people are diagnosed with head and neck cancer, i.e. malignant tumors of the oral cavity, throat, larynx, nasal cavity, paranasal sinuses and outer neck, especially the thyroid gland. Often, tumors develop from so-called leukoplakia, conspicuous white patches in the mouth and throat. Since they do not cause any symptoms, however, very few patients consult a doctor, explains Dr. Alfred Hansel, biologist and CEO of oncnostics, and adds that "most patients see a doctor only when they have severe difficulties swallowing. By then the tumor is often advanced and requires chemotherapy or surgery – depending on the location and type of tumor. At that point, cure rates are low. Therefore, we would like to develop a test that detects tumors early."

Study in five centers

To achieve this goal, the biotechnology company has launched a broad study in five centers. In a first step, a liquid biopsy is performed in patients diagnosed with a head and neck cancer prior to treatment in order to detect DNA methylation markers in saliva. If this is successful, further saliva or swab samples



©Eberhard Schorr, oncnostics



Dr. Alfred Hansel during the presentation of oncnostics at Medica 2023.

©Sonja Buske

are taken during follow-up to monitor the markers and assess relapses. "Going forward, we might be able to search for precisely these biomarkers in patients with an increased cancer risk, for example patients with leukoplakia," Hansel is confident. First test kits could become commercially available after the conclusion of the study in mid-2026.

According to Dr. Hansel screening the entire population is neither realistic nor necessary. Instead he supports the idea of a standardized screening program for groups at risk, i.e. smokers over 50 years of age and patients with an HPV infection. Similar to a Covid-19 test, Hansel says, the people in these groups could take the saliva samples themselves and send them to a laboratory. "To the best of our knowledge," he adds, "this process would be unique worldwide."

Cancer treatment advances

USC study findings: early blood test forecasts survival rates in patients with metastatic prostate cancer

The non-invasive test, which measures circulating tumor cells in the blood, can predict treatment response, disease progression and overall survival in men newly diagnosed with metastatic prostate cancer, according to new research led by USC Norris Comprehensive Cancer Center.

Source: Keck School of Medicine of USC

A blood test, performed when metastatic prostate cancer is first diagnosed, can predict which patients are likely to respond to treatment and survive the longest. It can help providers decide which patients should receive standard treatment versus who might stand to benefit from riskier, more aggressive new drug trials. The research, part of a phase 3 clinical trial funded in part by the National Cancer Institute (NCI) of the National Institutes of Health, was just published in JAMA Network Open.

Before it spreads, prostate cancer can be cured with surgery or radiation. Once the cancer has metastasized and is no longer curable, systemic treatments are used to prolong survival as much as possible. Biomarkers that predict how patients will respond could allow for better personalization of treatments, but they are few and far between.

A new study found that measuring circulating tumor cells (CTCs), rare cancer cells shed from tumors into the blood, is a reliable way to predict later treatment response and survival prospects. CTCs have been studied in prostate cancer before, but only in its later stages.

"No one, until now, has looked at whether CTC counts can be used right at the beginning, when a man first presents with metastatic prostate cancer, to tell us whether he's going to live a long or short time, or whether or not he will progress with therapies," said Amir Goldkorn, MD, lead author of the study and associate director of translational sciences at the USC Norris Comprehensive Cancer Center at the Keck School of Medicine of USC.

The research leveraged CellSearch (Menarini, Inc.), an FDA-cleared liquid biopsy technology at the Norris Comprehensive Cancer Center, to detect and measure CTCs in blood samples. Patients with more CTCs had shorter median survival lengths and a greater risk of death during the study period. Those with



An early blood test can predict survival in patients with metastatic prostate cancer, shows USC study
© kasto-stock.adobe.com

more CTCs also had less "progression-free survival," which refers to the length of time when a patient's disease is controlled by treatment without getting worse.

"You couldn't tell these men apart when they walked through the door," said Goldkorn, who is also a professor of medicine at the Keck School of Medicine. "All of their other variables and prognostic factors were seemingly the same, and yet they had very, very different outcomes over time."

The researchers say that the CellSearch blood test, which is already widely available from commercial providers, can help quickly identify patients who are unlikely to respond to standard treatment options. Those men could benefit from a more intensive approach to therapy, including clinical trials of new drugs that may have more side effects but could improve survival in these high-risk patients.

Counting CTCs

The research was part of a phase 3 clinical trial of the NCI-funded SWOG Cancer Research Network, a group of more than

1,300 institutions around the country that collaborate to study various cancers. Baseline blood samples from 503 patients with metastatic prostate cancer, who were participating in a new drug trial, were sent to the Keck School of Medicine team for analysis.

To analyze the blood samples, the researchers used the CellSearch platform at the Norris Comprehensive Cancer Center's Liquid Biopsy Research Core, a facility that Goldkorn founded and directs. CellSearch uses immunomagnetic beads, antibodies attached to small magnetic particles, which bind to CTCs in the blood and pull them out to be detected and counted by specialized equipment.

Patients with five or more CTCs in their blood sample had the worst outcomes. Compared to patients with zero CTCs, they were 3.22 times as likely to die during the study period and 2.46 times as likely to have their cancer progress. They were only 0.26 times as likely to achieve a complete prostate-specific antigen (PSA) response, meaning they responded poorly to treatment.

Men with five or more CTCs had a median survival length of 27.9 months following the blood test, compared to 56.2 months for men with one to four CTCs and at least 78 months for men with zero CTCs. (Many patients in the latter group survived past the date of publication, so the median survival length could not yet be calculated.)

The bottom line: more CTCs meant that patients survived for less time, progressed much more quickly and were unlikely to respond to standard treatments.

Candidates for clinical trials

The new study shows that measuring CTC counts at the start of therapy can predict long-term survival rates, even in men who go on to receive many treatments for metastatic prostate cancer over a years-long period. That means the test can help identify men early on for trials of new and potentially more aggressive therapies.

"We want to enrich these clinical trials with men who need all that extra help—who really would benefit from three drugs versus just two, or from being on a new chemotherapy drug, even though it may have more side effects," Goldkorn said.

Goldkorn and his team are now testing a new blood test that measures not just CTC counts, but also the molecular composition of CTCs and tumor DNA circulating in the blood, as well as other factors. Their goal is to create biomarkers with even more predictive power, which may ultimately help match patients with specific treatment options.

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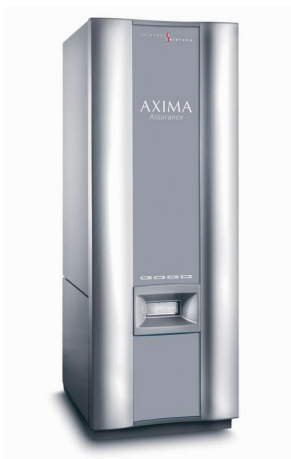
Microbiology

Mass Spectrometry



Mass Spectrometry

Shimadzu – Axima iDplus Assurance



Dimensions: 700 × 1920 × 850 mm (w × h × d)
Weight: 330 kg, excluding data system

Highlights: Axima Assurance – flexibility and quality: The Axima Assurance is designed with the general analytical and life science laboratory in mind. Incorporating a variable repetition rate 50 Hz N2 laser, the system provides high quality and high sensitivity rapid MALDI mass spectra and is particularly suited to identification in the microbiology field. Positive and negative ion modes are included as standard, allowing greater flexibility and extending the compound categories that may be analysed.

Mass Spectrometry

Shimadzu – Axima iDplus Confidence



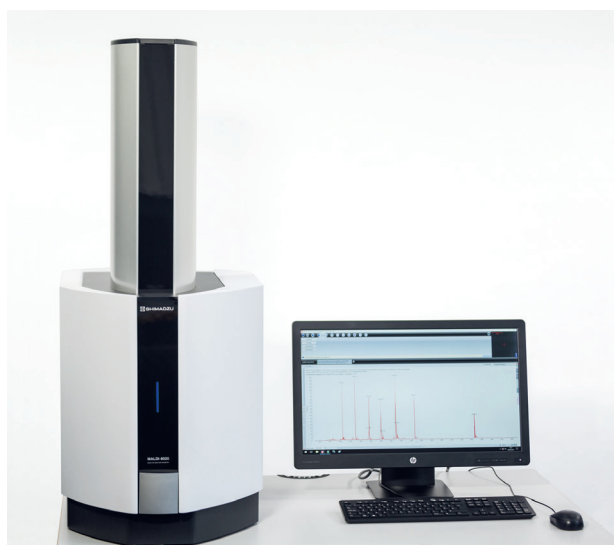
Dimensions: 700 × 1920 × 850 mm (w × h × d)
Weight: 330 kg, excluding data system

Highlights: iDplus Confidence – sensitivity and flexibility:

- Rapid microbial identification for research use
- Identifies and classifies strains based on phenotype characteristics
- SuperSpectra reduce the incidence of false positives and ensure robustness and reproducibility
- Open system allows addition of new species / entries to the database or the creation of new databases
- Clustering allows molecular profiling and tracking of change or evolution
- High performance MS for large molecule analysis
- MS/M

Mass Spectrometry

Shimadzu – MALDI-8030



Dimensions: 450 × 1055 × 745 mm (w × h × d)

Weight: 86 kg

Highlights: The Maldi-8030 is a benchtop, linear-only MALDI-TOF mass spectrometer designed to meet the needs of laboratories requiring a cost-effective MALDI-TOF platform. This newly designed MALDI-TOF mass spectrometer is functionally simple but provides outstanding MS performance in a compact footprint.

LABBOOK

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Subscription rate: € 22.– plus postage

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The strain typing technologies of tomorrow

Report: Wolfgang Behrends

Introduction

Cedars-Sinai Medical Center is a non-profit hospital and medical research institution that serves the Los Angeles community and surrounding areas. With pioneering medical research achievements, healthcare-defining education programs, and wide-ranging community benefit activities, Cedars-Sinai is setting new standards for quality and innovation in patient care. Among their many achievements is the successful typing of *Candida auris* species which could prove crucial in protecting patients from infection outbreaks caused by these microbes in healthcare settings.

The first reports of *C. auris* in the US came in 2015, but ongoing local transmission has since led to over 1,000 cumulative cases in Los Angeles County.^{1,2} Infection with *C. auris* is associated with high mortality rates, and it is often resistant to multiple classes of antifungal drugs.³ It spreads easily in hospital environments via colonized patients and contaminated surfaces or equipment.

The first step in fighting these infections is to identify the microbe responsible. Fast species identification followed by strain typing – to reveal clonal relations or differentiate genetic lineages – is beneficial. Traditional strain typing technologies like pulsed-field gel electrophoresis, multi-locus sequence typing, latex agglutination, and whole-genome sequencing, however, are time-consuming and resource-intensive. These technologies are also not readily available in all microbiology labs, which raises the question: could alternative emerging typing technologies fill the void?

New strain typing technologies

Microorganism strain typing is vital for infection control. Modern strain typing strategies tend towards molecular fingerprinting technologies.⁴ Fourier transform infrared (FT-IR) spectroscopy has shown promise as a rapid and non-invasive tool that requires minimal training to master. This technology delivers rapid strain-level discrimination of microbes, starting from culture, to provide a simpler alternative to next-generation sequencing strain typing.

IR spectroscopy measures the molecular vibrations associated with the absorption of IR light. Different chemical structures vibrate at different frequencies when this absorption happens. For example, the carboxyl group in fatty acids and lipids vibrates at 2800–3000 cm⁻¹ and the amide group in proteins vibrates at 1500–1800 cm⁻¹. IR-based strain typing works by combining the information from these absorption ranges to produce a

molecular fingerprint for a given sample. Microorganisms can be identified through the recognition of motifs in the fingerprint, particularly those belonging to carbohydrates. IR-based strain typing is relatively simple when compared with more traditional methods and achieves results faster, taking just 30 minutes for a single sample.

Researchers at Cedars-Sinai are capitalizing on the benefits of these technologies to find strategies to combat the threat presented by *C. auris*.

Targeting *C. auris*

Work conducted at Cedars-Sinai has helped guide the way in clinical applications for IR spectroscopy in California. The institute was the first in the US to evaluate a newly available FT-IR spectroscopy system for strain typing. Initial work focused on outbreaks of Gram-negative rod bacteria (such as *Pseudomonas aeruginosa*) and Gram-positive cocci (like *Staphylococcus aureus*), but the team soon turned its attention to *C. auris*. By 2021, IR spectroscopy was well-established for routine *C. auris* testing at Cedars-Sinai.

When the pandemic hit, the team sought to find a way to conduct surveillance for *C. auris* and prevent its transmission to at-risk individuals before admission to hospital. The initial real-time polymerase chain reaction (RT-PCR) platform for *C. auris* identification worked, but the hospital wanted to implement another layer of surveillance – and turned to IR technology.

Today, researchers at Cedars-Sinai are pioneering a first line of defense system. The first step is to detect *C. auris* via axilla or groin swabs using PCR to identify at-risk patients quickly and place them under the appropriate contact prevention precautions. The second step is to identify the strain type of the fungus via IR spectroscopy, starting from culture, for positive samples.

Identifying *C. auris* with PCR can provide an early warning system and help guide clinical decisions at the early stages of infection. Speed at this stage is critical to improve patient outcomes and, so far, the results have been promising. Researchers at Cedars-Sinai found that 4% of more than 700 at-risk patients (28 patients) at the center tested positive for *C. auris*⁵, with low numbers of genomic variation indicating local and ongoing transmission within the Los Angeles area, not exclusively within the hospital setting.

The institute has built a database of everyone admitted to Cedars-Sinai who tested positive for *C. auris*. This valuable resource will help to identify possible future outbreaks rapidly.

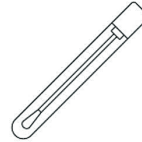
Step 1: Rapid Identification of *C. auris* by PCR

Axilla/Groin Swab

Skilled Nursing Facility (SNF)

Long-term Care Hospital (LTACH)

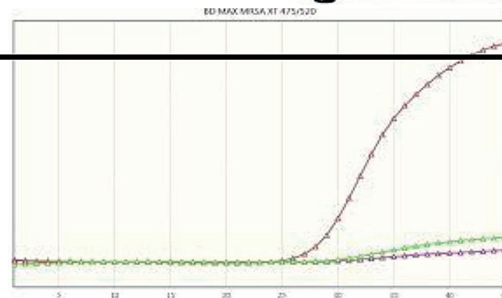
Chronically ventilated with tracheostomy



Patient placed on
Contact Isolation Precautions



~3 hours from
receipt

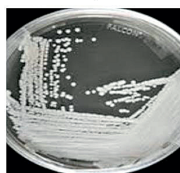


Positive sample (+)

Negative Sample (-)

Patient Remains on
Contact Isolation Precautions

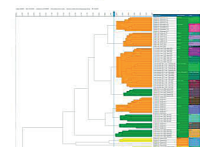
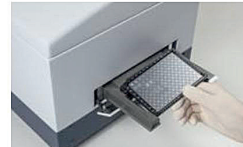
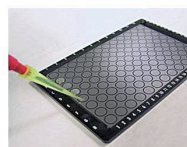
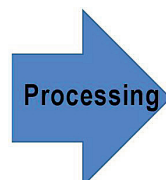
Patient Removed from
Contact Isolation Precautions



C. auris isolated Susceptibility
24-48hrs testing

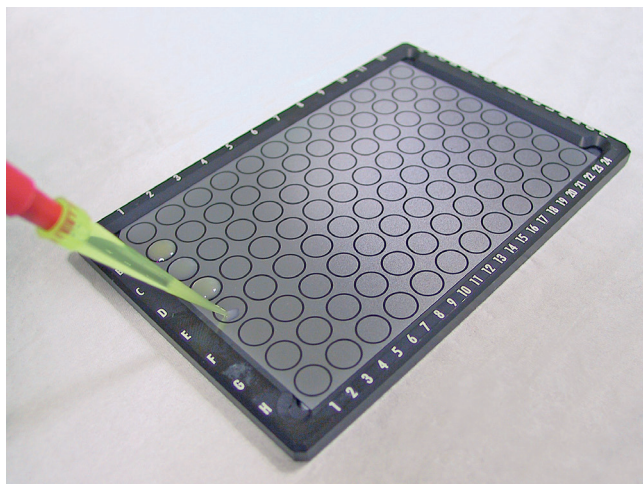
Step 2: Strain typing by IR Biotyper

~3hrs
Complete Workflow



Two-tier clinical surveillance diagnostic algorithm for the detection of *C. auris*.

©Contreras DA, Morgan MA, Frontiers in Cellular and Infection Microbiology 2022 (CC BY 4.0)



Application of samples on a microtiter plate

© Bruker

Looking forward

Antimicrobial resistance (AMR) is considered one of the greatest health threats facing humanity.⁶ Despite the rapid global spread, it is difficult to predict the actual burden of the infection as the standard laboratory methods fail to correctly identify the fungi.⁷ This emphasizes the importance of the strain typing work that is ongoing at Cedars-Sinai, and targeting *C. auris* is only the beginning. The Cedars-Sinai team is now evaluating IR spectroscopy for the identification of *Mycobacterium abscessus* subspecies. Validation of this application could facilitate strain typing and clarithromycin susceptibility testing for *Mycobacterium abscessus* in a shorter time than current methods. What factors will ensure the success of tomorrow's typing technologies? Outside-of-the-box thinking, innovative instrumentation, and clear communication are among the most important qualities to consider. Central to this will be increasing awareness and advancing the diagnostic methods for early disease detection and control.

Note: The testing procedure was developed by the researchers for the specific use in the Cedars-Sinai Medical Center only. The IR Biotyper is not intended for the examination of specimen from human body to define or monitor therapeutic measures.

References

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- ⁶ World Health Organization. Antimicrobial resistance 2021. Available at: <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance> (Accessed April 2023)
- ⁷ Ademe M & Girma F. *Candida auris*: From Multidrug Resistance to Pan-Resistant Strains. *Infect Drug Resist.* 2020 May 5;13:1287–1294. doi: 10.2147/IDR.S249864



PROFILE

Dr. Margie Morgan is the Medical Director of Clinical Microbiology for Pathology and Laboratory Medicine at Cedars-Sinai Medical Center. Dr. Morgan oversees clinical testing within the microbiology laboratory, guides staff conducting diagnostic tests, provides teaching services for residents and fellows, and participates in researching new diagnostic techniques within microbiology.



PROFILE

Dr. Deisy Contreras is the Clinical Associate of the Clinical Microbiology Laboratory in the Department of Pathology and Laboratory Medicine at Cedars-Sinai. Dr. Contreras researches the application of diagnostic techniques within laboratory workflows.



PROFILE

Markus Meyer, PhD is head of the Business Unit Hygiene/ Epidemiology at the Microbiology and Infection Diagnostics (MID) Division of Bruker Daltonics GmbH & Co. KG in Bremen, Germany. He has been with Bruker Daltonics since 2010 as a product manager for various life science mass spectrometry instruments before joining the Microbiology & Infection Diagnostics team as global product manager for consumables in 2018.

Blood Glucose
Blood Gases/
Electrolytes/
Metabolites/Oximetry
Endocrine
Clinical Chemistry
Other



nova
biomedical

Blood Glucose

Nova Biomedical – StatStrip Glucose/Ketone*



- Highlights:** The only glucose meter technology cleared by the US FDA across all professional and healthcare settings, including critical care.
- Measures and corrects glucose errors caused by abnormal haematocrit levels
 - Measures and corrects errors caused by electro-chemical interferences
 - Measures blood beta-hydroxybutyrate, the preferred ketone for diagnosing ketoacidosis
 - Available as a fully connected, wi-fi meter, or a smaller Xpress* style meter

*StatStrip Glucose only in the US

Blood Gases/Electrolytes/Metabolites/Oximetry

Nova Biomedical – Prime Plus Critical Care Analyser



Assays: PO₂, PCO₂, pH, Hct, tHb, MCHC, Na, Cl, K, iCa, TCO₂, iMg, Glu, Lac, Urea (BUN), Creat, ePV, SO₂%, O₂Hb, COHb, MetHb, HHb, HbF*, tBil*

Highlights: Stat Profile Prime Plus offers a complete test menu panel in about one minute, along with bidirectional connectivity, a robust data management system, and comprehensive cybersecurity protection.

This comprehensive critical care menu includes iMg, urea and creatinine and calculated tests for ePV, MCHC and OI.

*Not available in the US or Canada

Blood Gases/Electrolytes/Metabolites/Oximetry

KABE Labortechnik – Consumables for blood gas analysis



- Highlights:** The best sampling system in every situation
- Plastic blood gas capillary:
- Unbreakable plastic
 - Fast drawing
 - Crystal clear
 - Numerous drawing volumes and diameters available
 - Minimum gas permeability for oxygen and carbon dioxide
 - Comprehensive range of accessories
- Blood gas tube:
- Rapid anticoagulation thanks to liquid preparation
 - Optimal filling with special piston geometry
 - Individual sterile packing
- Both sampling systems are prepared with balanced heparin and are ideal for blood gas and electrolyte analyses on all common blood gas systems.

Blood Gases/Electrolytes/Metabolites/Oximetry

KABE Labortechnik – Pipette-Adapter for Capillaries (PAC)



- Highlights:** Assists in the handling of capillaries and their targeted draining on POCT-analysers and test strips or into vessels
- Suitable for different capillaries regarding measurements and preparations
 - Available individually or completed with capillary
- Handling:
- Fix capillary in the PAC while using oneway gloves
 - The capillary is filled as usual – afterwards the thumb is put gently on the upper mouth of the PAC
 - The (dropwise) draining is carried out by generating a slight gauge pressure with the thumb

Endocrine

Nova Biomedical – Allegro* – a fast simple capillary blood analyser



- Assays:** HbA1c, Lipids panel, PT/INR, CRP, blood glucose and creatinine, urine albumin and creatinine
- Highlights:** Allegro* offers a clinically important menu of 10 measured and individually selectable tests, plus 7 calculated tests. All tests are measured with disposable, ready-to-use cartridges or test strips, and are easily performed by non-technical personnel.
- Capillary fingerstick samples for all blood tests
 - Immediate test results during the patient visit
 - Reduces patient follow-up visits and costs
- *Not available in the US or Canada*

Clinical Chemistry

Nova Biomedical – StatSensor Creatinine



- Highlights:** Fingerstick capillary testing for creatinine
- The StatSensor Creatinine is a handheld analyser and miniaturized, single-use biosensor for whole blood creatinine testing. StatSensor Creatinine's advanced technology enables simple, rapid, and accurate assessment of renal function by fingerstick capillary blood sampling at the point of care. Available as a fully connected meter, or a smaller Xpress* style meter.
- Capillary sampling
 - Creatinine and eGFR results in 30 seconds
 - 1.2uL sample
 - Calculates eGFR by CKD-EPI and MDRD equations
- *Not available in the US and Canada*

Other

Nova Biomedical – EMS Stat*



- Highlights:** Lactate, haemoglobin, haematocrit, glucose, and ketone for early patient assessment and treatment
- Fingerstick capillary sample
 - Results as fast as 6 seconds
 - Laboratory-quality accuracy
 - Durable carrying case holds meters, single-use biosensors, controls, and lancets
- EMS Stat* offers simple, fast, and accurate testing in the field. Two meter systems are available. One provides patient data storage plus wireless connectivity to external data managers, the other provides data storage only.
- *Not available in the US and Canada

Other

Nova Biomedical – StatStrip Lactate / Haemoglobin/Haematocrit*



- Highlights:** Fingerstick capillary testing for Lac, Hb, and Hct
- The StatStrip LAC / Hb / Hct is a handheld, easy-to-use meter that measures lactate, haemoglobin and haematocrit at the point-of-care using two disposable biosensors and tiny capillary blood samples for all tests. Available as a fully connected, wi-fi meter, or a smaller Xpress style meter.
- Capillary sampling
 - Measured Hb and measured Hct in 40 seconds from 1.6µL blood
 - Measured lactate in 13 seconds from 0.6 µL blood
- *StatStrip Lactate only in the US and Canada



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mg^o fach
verlage

E-skin patches

How “intelligent” skin could highlight cardiac conditions

Two companies are combining their unique expertise to develop intelligent e-skin patches to “self-sense” cardiac events in patients. The flexible patch platform will deliver a comprehensive understanding of both electrical and mechanical heart activities and has the potential to enable cardiologists to better monitor their patients.

Report: Mark Nicholls

The initiative, which sees STMicroelectronics and DuPont Liveo Healthcare working to develop the wearable platform, was outlined during a presentation by Oriana Di Marco from STMicroelectronics and DuPont's Jennifer Gemo at Medica in Dusseldorf in November.

Speaking to European Hospital after the conference, Di Marco, who heads EMEA Strategic Business Development for Health & Well-being at STMicroelectronics, said: ‘The companies’ respective contributions to this development is our long-term

vision for an intelligent electronic skin patch that can self-sense a cardiac event and act immediately at the point of need’.

For the e-skin project, STMicroelectronics provide a smart, flexible electronic board with innovative sensing, low power management, processing, and in-sensor and microcontroller AI capability embedded in a single module. This technology pairs with the DuPont Liveo silicone technology with electrically conductive properties.

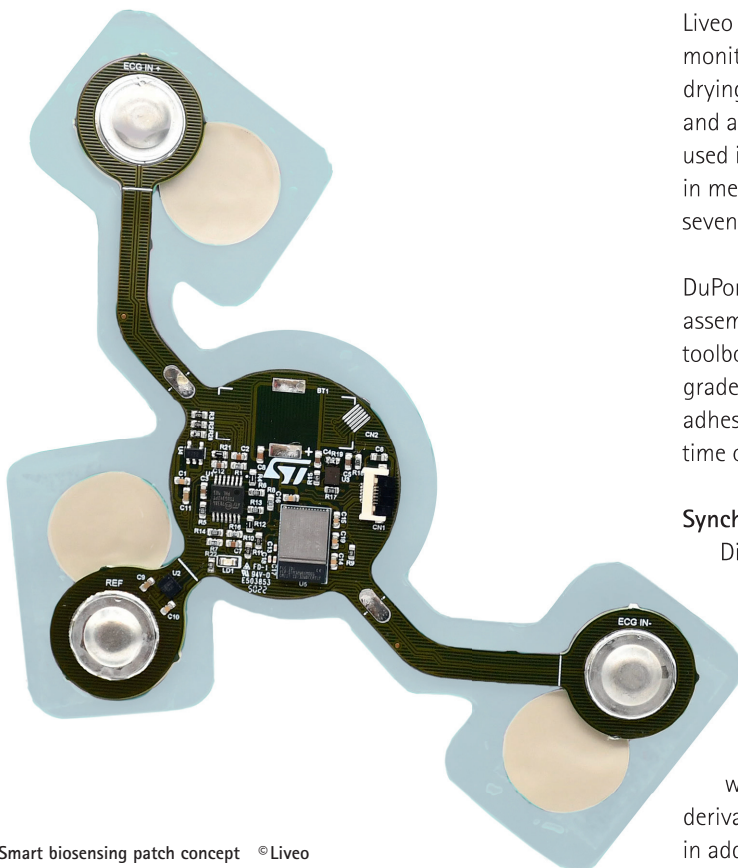
Durable, but gentle

Gemo, who is Global Strategic Marketing Leader with DuPont Liveo Healthcare, explained how medical professionals can use Liveo Soft Skin Conductive Tape as a skin electrode for biosignal monitoring. She emphasised that good skin conformability, no drying over time, and repositionability with gentle adhesion and atraumatic removal are vital. ‘The conductive tape can be used in single electrodes for short-term monitoring, as well as in medical wearable patches for long-term monitoring lasting seven or more days’, she continued.

DuPont – which carried out the full design, processing, and assembling of the patch prototype solution – also provides a toolbox for wearable medical devices that includes biomedical grade elastomer for hardware encapsulation and soft skin adhesive for skin gentleness, repositionability, and long wear time of the patch onto the body.

Synchronized and contextualized measurements

Di Marco outlined how the flexible patch platform prototype supports heart monitoring. As electrocardiography (ECG) and seismocardiography (SCG) signals are detected in the same sensor, they are fully synchronized as they occur. ‘Moreover, by using the artificial intelligence capabilities embedded in the sensor and in the microcontroller, it's possible to contextualize the measurement within the wearer's daily activities as well as supporting the derivation of other vital signs like non-invasive blood pressure, in addition to respiration rate and heart beats’, said Di Marco.



Smart biosensing patch concept ©Liveo

Clinicians benefit from a better understanding of the heart rhythm and main vital signs during a patient's visit and once they have left the doctor's practice. 'The patch's intelligence lets it detect changes in normal patterns and alert the patient, who can share the data with the physician,' she added.

Catering to cardiologists' requirements

Patient benefits are related to the characteristics of the wearability of the patch. The patch can be worn longer without irritating the skin and it is flexible, lightweight, and can be repositioned easily. In terms of how this is advancing the field and patient care, Gemo said: 'The cardiac market is one of the most advanced in technological adoption, with cardiologists demanding longer wearability, better data, and superior design. They are clamouring for small, flexible, and waterproof patches that deliver improved comfort, longer wear, and higher signal quality over time.'

Such requirements are driving the trend for continuous and remote cardiac monitoring outside of the hospital and in patient's homes, where patient comfort leads to improved compliance.

The two companies have provided a toolbox of technologies to address these needs and delivered a prototype that improves signal quality and patient comfort over time.

Next step

The patch is also suited to applications beyond cardiac monitoring. It can be positioned in various places of the body and use different algorithms to detect other biological functionalities.

For DuPont Liveo, the next step is to build prototype patches for further testing and to provide reference designs and components to build similar patches to monitor other functions. While acknowledging that vital-sign monitoring is a high-growth market, Gemo said its key needs are improved signal quality and patient comfort.

STMicroelectronics and DuPont have portfolios suited for wearables and electronic skin patch applications. DuPont Liveo Healthcare enables next-generation wearables through its toolbox of technologies, including medical-grade elastomers, adhesives, resins, and thermoplastics; while ST is developing a new class of motion sensors with an embedded vertical analog front end that opens new categories of human-centric applications.



Soft skin conductive tape ©Liveo



PROFILE

Oriana Di Marco is Head of EMEA Health & Well-being Vertical, Strategic Business Development at STMicroelectronics. With a master's degree in Biological Science and an Executive MBA, Di Marco has a distinctive scientific background combined with advanced semiconductor knowledge from 20 years at ST. She is a recognized expert in molecular diagnostics, drug delivery for diabetes, microfluidics technologies and medical devices.



PROFILE

Jennifer Gemo is Global Strategic Marketing Leader for DuPont Liveo Healthcare at DuPont Industrial Solutions. She is responsible for developing and driving the global growth strategy for DuPont Liveo and supports the development and commercialization of several growth innovation platforms for Liveo. Prior to her current role, she was the global segment leader for Medical Devices.

Other Applications



Blood Collection

KABE Labortechnik – Capillary Blood Collection GK



- Highlights:** Capillary Blood Collection GK – for small amounts of blood
- The system offers special advantages for the collection of blood samples from new-borns, children, elderly people and emergency patients, thus everywhere, where only small amounts of blood are available
- The test vessel is prepared on the entire inner surface. Besides it can be used as centrifugal vessel
 - The capillary is coated on the entire inner surface and guarantees an exact filling volume
 - The attached stopper, which is optionally available with an integrated elastically resealable rubber membrane, offers perfect tightness
 - Different measurements and preparations are available

Blood Collection

KABE Labortechnik – KABEVETTE® G



- Highlights:** The closed, drip-free system with rubber membrane for single and multiple collection
- Aspiration technique for all vein conditions
 - No dripping after single or multiple collection
 - High-quality rubber membrane closure guarantees absolute leak-tightness
 - Vacuum technique possible
 - Available in different tube sizes and preparations
 - Adapter with safety catch provides a safe connection between tube and cannula

Other Applications

Centrifuges

Hettich – Mikro 220 | 220 R

Dimensions:
330 × 420 × 313 mm (w × h × d)

Weight:
21 kg / 42 kg

Rotational frequency:
18,000 min⁻¹

Relative centrifugal force:
31,514



- Highlights:**
- Compact, high-performance microlitre centrifuge
 - Choice of seven rotors
 - IvD-conform according to directive 98/79/EC
 - Impulse key for short cycle mode
 - Nine program memories for more individuality
 - Nine individual acceleration and deceleration stages
 - Model 220 R coolable from -20 to +40 °C with pre-cooling function
 - Max. number of tubes: 60 × 2.0 ml

Centrifuges

Hettich – Universal 320 | 320 R

Dimensions:
401 × 529 × 346 mm (w × h × d)

Weight:
31 kg / 52 kg

Rotational frequency:
16,000 min⁻¹

Relative centrifugal force:
24,900



- Highlights:**
- The universal choice among the benchtop centrifuges
 - Choice of 18 rotors
 - IvD-conform according to directive 98/79/EC
 - Impulse button for short centrifugation
 - Impulse key for short cycle mode
 - Nine program memories
 - Nine individual acceleration and ten deceleration stages
 - Model 320 R coolable from -20 to +40 °C with pre-cooling function
 - Max. number of tubes: 4 × 200 ml / 6 × 94 ml

Centrifuges

Hettich – Rotina 420 | 420 R

Dimensions:
506 × 650 × 423 mm (w × h × d)

Weight:
75 kg / 108 kg

Rotational frequency:
15,000 min⁻¹

Relative centrifugal force:
24,400



- Highlights:**
- High-performance with first-class equipment
 - Choice of five rotors
 - IvD-conform according to directive 98/79/EC
 - Max. noise level of 51 dB(A) with rotor 4790-A
 - 98 program memories for more individuality
 - Nine individual acceleration and deceleration stages
 - Model 420 R coolable from -20 to +40 °C with pre-cooling function
 - Max. number of tubes: 4 × 600 ml

Incubators

Hettich – HettCube 600 R

Dimensions:
710 × 825 × 1990 mm (w × h × d)

Weight:
175 kg

Temperature range:
0 °C to +65 °C

Internal volume:
520 l

Energy consumption at 37°:
0.056 kWh/h



- Highlights:**
- Only 0.6 m² footprint
 - Up to 67 percent of usable volume
 - Fast and easy access, one-hand operation door
 - Perfect conditions with unique temperature regulation
 - Real-time calendar
 - Week programming with holiday function
 - Flexible alarm settings
 - Wide range of program functions (Start after time, start after temperature etc.)
 - Up to four shelves included in standard
 - Automatic door closure with magnetic seals
 - Low noise level of ≤ 44 dB(A)

Histology Equipment

KABE Labortechnik – Consumables for Pathology/Histology



- Highlights:** Test tubes for pathology and histology in various dimensions
- Prefilled with 4 % formaldehyde solution
 - Screw caps for absolute leak-tightness
 - Tubes available with (individual) label with /without barcode and tear-off label
 - Untreated tubes with enclosed lid also available
- Furthermore: precise filling of customers' reagents possible on in-house filling-systems

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