ADVERTISEMENT FEATURE

Global solutions through global collaborations

As part of its nearly 150-year endeavour to contribute to society by developing analytical and measuring instruments, the Shimadzu Corporation has established Shimadzu innovation centres around the world. Two collaborations between the European Innovation Center and academic institutions will IMPROVE FOOD QUALITY AND ADVANCE CANCER TREATMENT.

The European Innovation Center was opened in 2017 in Duisburg, Germany.

Enrico Davoli with a probe electrospray ionization mass spectrometry system (an instrument for research use only).

Erich Leitner with an analysis system for mineral oil saturated hydrocarbons and mineral oil aromatic hydrocarbons.

Back in 1875, the Shimadzu Corporation was started by one man in Kyoto, Japan. Today, it has become a global company that boasts more than 10,000 employees, who all strive to fulfill its goal of contributing to society through science and technology. To continue this tradition into the future, Shimadzu has been establishing Shimadzu Innovation Centers (SICs) across the globe from 2014.

As part of this innovative, the European Innovation Center (EIC) was opened in 2017 in Duisburg, Germany. Based on the growing network Shimadzu has nurtured since its arrival in Europe more than half a century ago, the EIC focuses on four industries: clinical applications, composites, food, and imaging technologies. It currently has 13 projects in these areas that aim to change how societies preserve food, practice medicine and protect the environment.

IMPROVING FOOD-SAFETY STANDARDS

Erich Leitner, a leading expert on food quality at the Graz University of Technology in Austria, heads one of these projects. He is a major node in the local food network, having strong connections with food producers and farmers in the region. Leitner has been using Shimadzu chromatographs and mass spectrometers for more than a decade to study food. To him, scents and chromatograms are the same: "When I smell a substance, I can visualize its molecular structure," he says.

Leitner takes as strong an interest in the packaging as in the food itself. Companies invest an enormous amount of time and money to insure their foods have the right food chemistry for the best flavour. But all that effort can be lost by the packaging. Be it pasta in paper boxes, sugar in plastic bags, or chocolate in foil wrapping, food quality can be deteriorated by molecules leaking from the packaging. This is particularly problematic for foods that are kept in their packaging for months or even years.

Contamination can sometimes be recognized by a change in taste or aroma, but not all contaminants can be detected by our senses. That is the case for mineral oil saturated hydrocarbons (MOSHs) and mineral oil aromatic hydrocarbons (MOAHs). MOSHs are known to accumulate in the body, while MOAH are associated with potentially carcinogenic substances. The European Commission is expected to set strict guidelines on the acceptable levels of MOSHs and MOAHs in foods within the next two years, but these guidelines have been delayed by the lack of standardized methods. Besides contributing to food safety, such methods would assist in determining the manufacturing stage at which contamination occurs.

"We monitor everything from the raw ingredients to the final product," Leitner explains. "The more you process a food, the higher the risk of contamination."

ENDURING PARTNERSHIPS

EIC and Leitner have teamed up to solve this problem. Shimadzu is developing automated chromatography and mass spectroscopy systems that reduce the amount of human handling and thus experimental errors, while Leitner is employing his expertise to establish sample preparations and analysis protocols to optimize these instruments. The automated system allows Leitner to test 50 samples a day. In contrast, previous methods could take as long as two days for some samples. When daily production is measured in tonnes, any reduction in time can translate into huge savings.

Leitner has been working with Shimadzu for so long and on so many projects that he cannot remember who first proposed the study of MOSHs and MOAHs. Either way, there was little doubt he would join.

"Many people think they can do analytical measurements by buying equipment," he says. "But that's only half the story; you also need good people."

Leitner has been convinced that those people are at Shimadzu ever since two of the company's engineers came and configured his first Shimadzu instrument over several days.

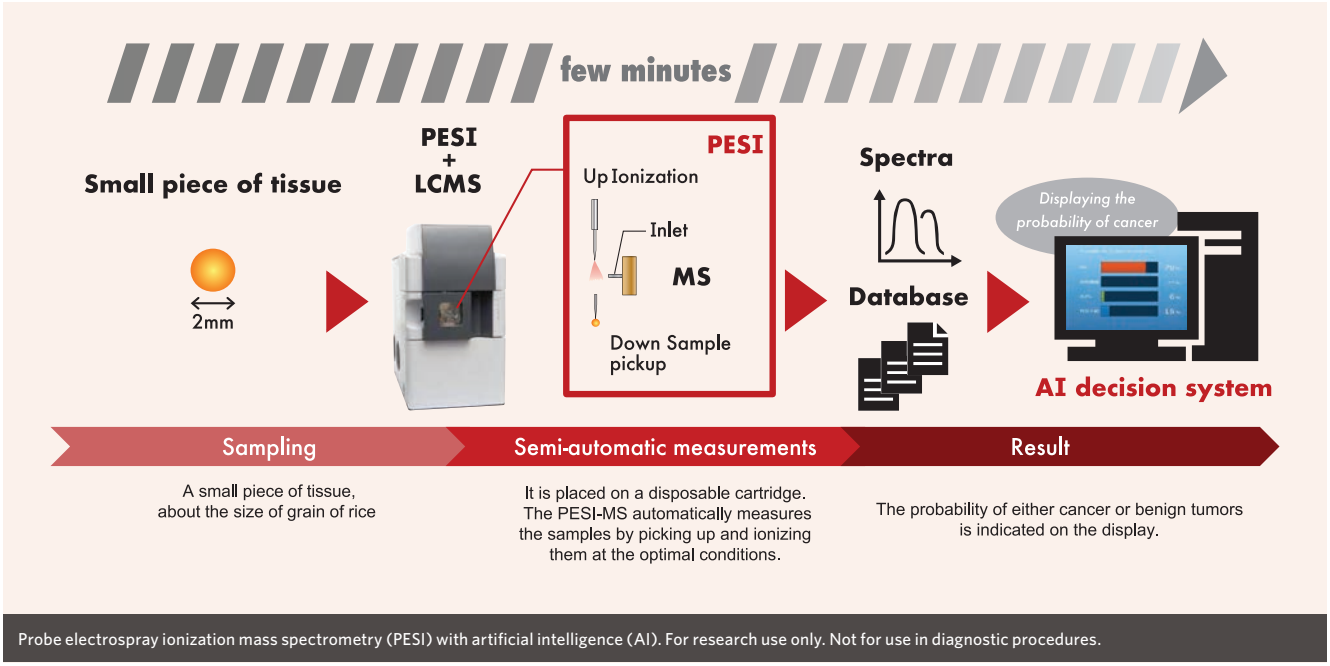
"I was able to test a multidimensional gas chromatography–mass spectroscopy system with an additional sniffing port exclusively for two days with two experts," Leitner recalls. "I was impressed by their performance and customer service."

Working with the EIC has allowed Leitner to explore the problems that most interest and inspire him, namely, food quality. "I'm absolutely crazy about food quality," he says. "I'm one of the luckiest people in the world — my job is my hobby."

DIAGNOSING LIVER CANCER FASTER DURING OPERATIONS

In contrast, there is no doubt about who proposed the collaboration on a cancer project between Shimadzu and Enrico Davoli, a researcher at the Mario Negri Institute for Pharmacological Research in Milan, Italy, and the first president of the Italian Mass Spectrometry Society. Shimadzu proposed collaborating with Davoli. This followed a successful collaboration with Sen Takeda of Yamanashi University, Japan, to study a new system that combines artificial intelligence (AI) with probe electrospray ionization mass spectrometry (PESI-MS) to support the clinical diagnosis of liver cancer cells. Hepatocellular carcinomas are a leading cause of cancer death. They are commonly treated by resecting cancer cells, but scientists disagree about just how much healthy tissue should be taken to optimize patient survival. Some researchers believe that only cancerous tissue should be removed, whereas others argue that it is safer to also excise a small buffer zone of healthy tissue. During the operation, the surgeon will pass a specimen to a pathologist, who will perform histology to determine whether more resection is needed. Each specimen takes about 30 minutes to prepare and

Advertiser retains sole responsibility for content



Probe electrospray ionization mass spectrometry (PESI) with artificial intelligence (AI). For research use only. Not for use in diagnostic procedures.

diagnose, which not only raises the cost of the operation, but also increases the chance of infection.

Japan ranks near the top of the world for patient outcomes for liver cancer, in large part because of its innovative diagnostic technologies. In the project between Davoli and Shimadzu, AI is trained to diagnose a specimen from PESI-MS data without any histology or other laborious preparation. AI then outputs a binary decision, normal or cancer, with a statistical probability. The whole process — from the time the surgeon acquires the specimen to the AI decision — takes no longer than two minutes.

After Takeda and Shimadzu had shown the effectiveness of this approach in Japan, it was not apparent whether it could exported to other countries, since the AI was originally trained with data from Japanese patients. That was when Shimadzu contacted Davoli and asked if he could acquire patient samples from Italian hospitals. Davoli was thrilled to take part.

"For a researcher, having a prototype and being the first to try something is a dream realized," he says. "The instrument is brand new. The approach is brand new. It was a great opportunity."

The early results are promising, and Davoli is extending his collection to samples for other solid tumours with funding from Shimadzu.

"Our plan is to work with other European nations to test PESI-MS on other populations," he says, adding that the EIC has been instrumental at building the continental research network.

THE PRIMARY GOAL OF THE SICS IS TO BENEFIT SOCIETY

A HYBRID PARTNERSHIP

SICs can be viewed as a hybrid between industry and academia. All SICs aim to create new commercial markets, but markets grow not only from economic need, but also by training experts, explains Ann-Christin Niehoff, EIC product manager of imaging, "More than 90% of PhD chemists do not stay in academia," she says. "We help build their careers."

Shimadzu funds PhD students and will even be co-investigators on grants. Examples include collaborative projects at Limoges Hospital, France, and the University College London, United Kingdom, where the EIC is supporting PhD grants for three years.

Shimadzu believes that no matter the excellence of its instruments, the primary goal of its SICs is to benefit society. SICs therefore view their research collaborations as a partnership that promotes academic independence, encourages academic publications and supports academic education.

The success of SICs lies in developing new ideas, which is why the teams are continually consulting with university researchers to learn about the kind of scientific problems that Shimadzu innovation can help solve. It is also why SICs develop research networks. For example, Shimadzu researchers introduced Davoli to Takeda and invited Leitner to speak at the inaugural Global Innovation Summit in Kyoto in 2017, where he got to meet other SIC partners in academia.

By contributing to society through science and technology, Shimadzu and its SICs want to translate research into scientific solutions for some of the greatest challenges facing the world. ■

All the instruments mentioned in this article are research-use only instruments and are not used in diagnostic procedures. Shimadzu is an analytical equipment provider and in certain regions, including the USA, Shimadzu products may be regulated as for research purposes only. If you have questions on approved use of a Shimadzu device, please contact your regional office.

SHIMADZU
Excellence in Science
www.shimadzu.com