CONNECTED

A MAGAZINE BY

LEMO

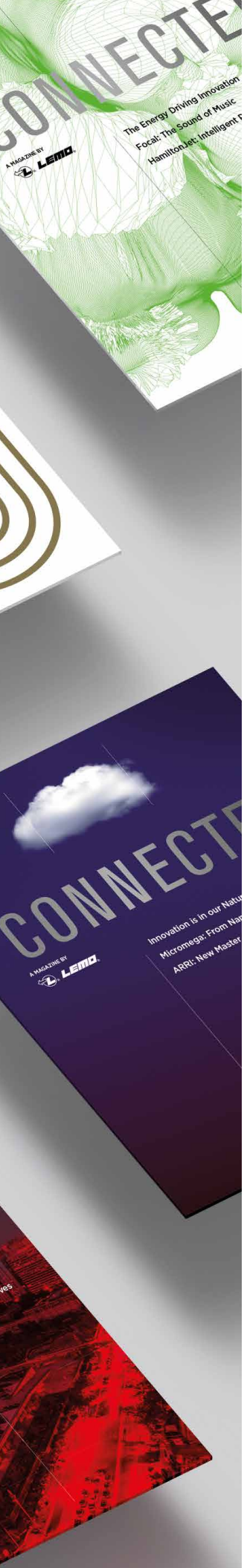
SPRING 2018 N° 10

Precious Uncontrollable Medical Data

Smart Needle for Spinal Operations

Revolutionising Disability Motorsport


CONNECTED
SPRING 2015 N° 3
A MAGAZINE BY LEMO
The Irresistible Rise of Commercial Drones
LEMO Engineers at your Service
Underwater Kites to Harness Ocean Power
CONNECTED
WINTER 2016 N°7
A MAGAZINE BY LEMO
Advanced Technology to Heal Arterial Disease
Connecting the World: The LEMO Story
CONNECTED
SOMMER 2015 NR. 4
EIN MAGAZIN VON LEMO
Die faszinierende Welt des 3D-Drucks
LEMO – mehr als nur Steckverbinder
Okazaki: Technologie auf hohem Niveau
CONNECTED
JULY 2014 N°1
Startup
ontribution to Motorsports
the Robot Factory Worker
CONNECTED
HERBST 2014 NR. 2
EIN MAGAZIN VON LEMO
Rettung mit Hubschrauber in großer Höhe
Northwire, LEMO's neue Kabel-Verbindung
Studenten auf der High-Tech Rennstrecke
CONNECTED
WINTER 2015 N° 5
A MAGAZINE BY LEMO
Meeting China's Quest for Greater Quality
Extreme Cold: Only the Strongest Tech Survi
Powerful Solutions for Quieter Cities



EDITORIAL

JOIN IN OUR JOURNEY INTO THE WORLD OF HI-TECH

4 years ago, we wanted to find a way to share our passion for Hi-Tech with you, dear customers and partners, so we launched CONNECTED.

It was a somewhat crazy idea: we knew that plenty of other technical publications had been out there to attract your attention. Following the worldwide positive feedback we received, we decided to continue offering our magazine to you and so we have come to the 10th issue already! CONNECTED is published in English, German and Chinese, printed in 20,000 paper copies and is also available in digital format on our website.

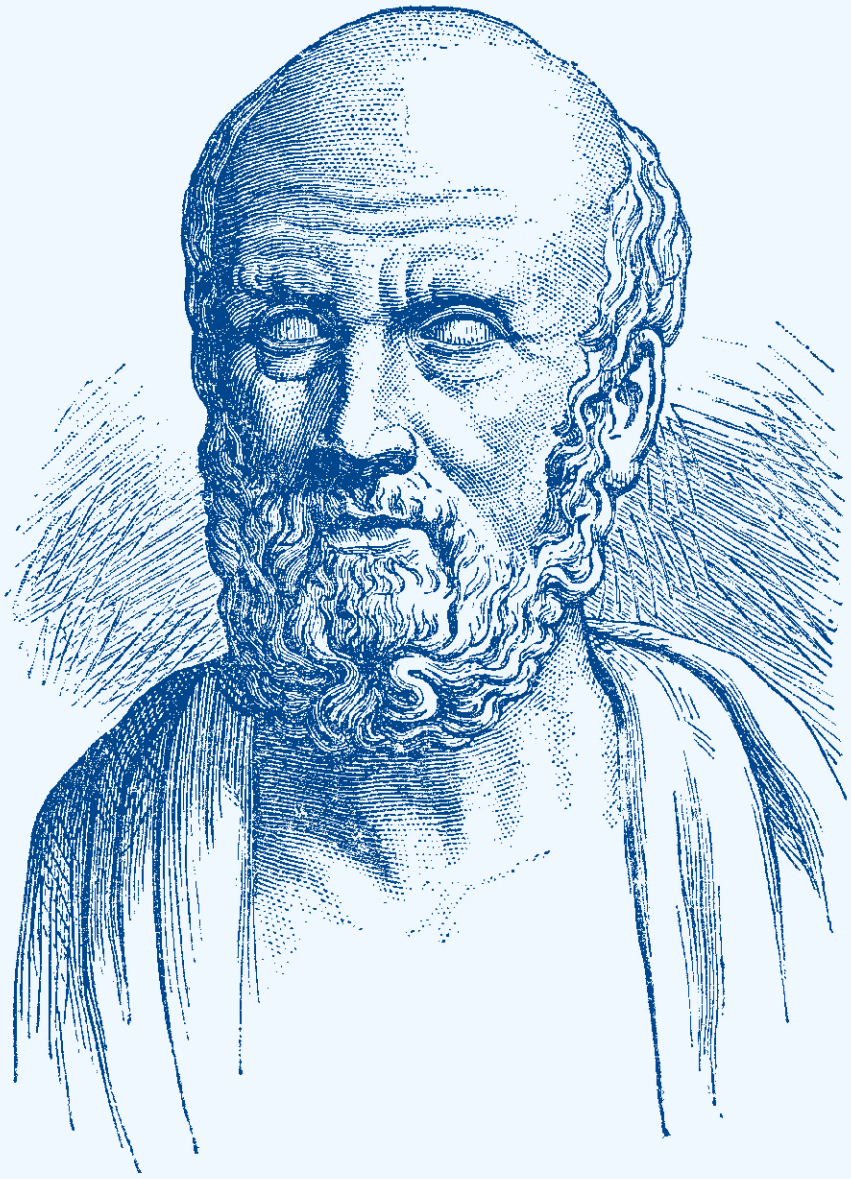
So far, CONNECTED has already led us from space exploring telescopes to turbines harnessing deep sea currents. From sensors operating at 2,200 degrees to vehicles equipped to drive to the North Pole. We have listened to experts in satellites, energy, the environment, drones, 3D printing and motor sport. We have travelled in the wake of innovators and their innovations – among them, your companies and LEMO.

This 10th issue will carry on down this road. It includes, among other topics, a special feature dedicated to medical technologies: swallowable cameras, intelligent needles, spinal surgery robots... We will continue our fascinating exploration with you and all this thanks to you. Off we go!

Alexandre Pesci
CEO LEMO

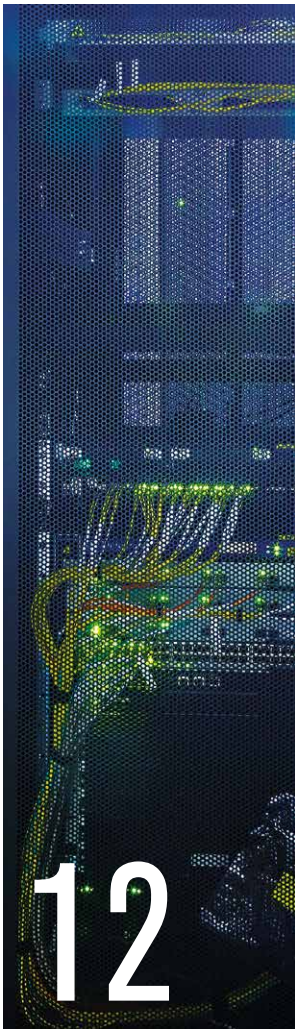
“Wherever the art of medicine is loved, there is also a love for humanity.”

Hippocrates (c. 460 – c. 370 BC), Greek physician, the « Father of western medicine »



DISCOVER IN OUR SPECIAL FEATURE SOME EXAMPLES OF WHAT HIS MODERN-DAY PEERS HAVE INVENTED OUT OF LOVE FOR MEDICINE AND HUMANITY. SEE PAGES 10-23

IN THIS MAGAZINE



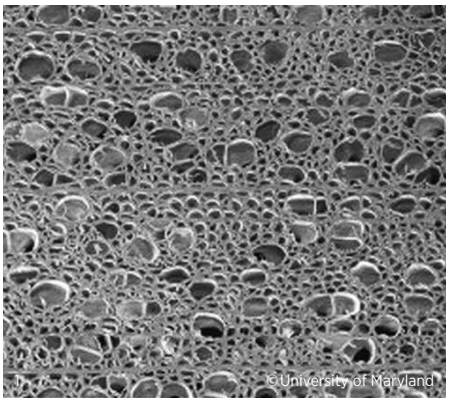
IMPRESSUM

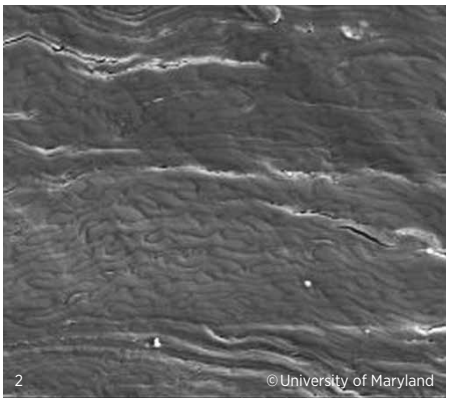
EDITORIAL BOARD:
Alexandre Pesci, Judit Hollos Spoerli, Peter Dent, Serge Buechli, Raymond Voillat, Essencedesign

ENGLISH TRANSLATIONS:
Judit Hollos Spoerli

GRAPHIC DESIGN:
Essencedesign

TECH-BITS FROM AROUND THE WORLD





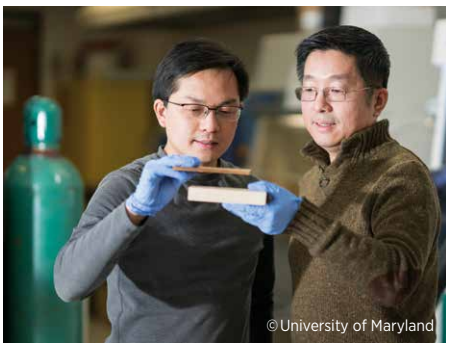
▲ Magnified images of the same wood panel (1) Before and (2) After processing

DIAGNOSTIC PILLS

A research team from the Royal Melbourne Institute of Technology (RMIT) has developed a swallowable capsule, containing sensors which can measure the presence of various targeted gases in the digestive system. Based on the results obtained through this new intestinal diagnostic tool, it will be possible to prescribe personalised diets and treatments for better overall health. Less invasive than endoscopy (also see page 19) and more precise than breath tests, it could also detect early signs of disorders such as Crohn's disease, colitis, irritable bowel syndrome and even colon cancer.

WOOD IS THE FUTURE

Engineers at the University of Maryland (UMD) have found a way of making wood 12 times more resistant and 10 times stronger than before. Their new process, comprising of a chemical treatment before being compressed under heat, creates a massive number of bonds between hydrogen atoms and cellulose nanofibres already present in the natural structure of wood. Thus, it acquires characteristics comparable to carbon fibres or titanium alloys, but at much lower cost and in a more sustainable way. Some already foresee cars, aeroplanes and even bullet-proof shielding made of wood!

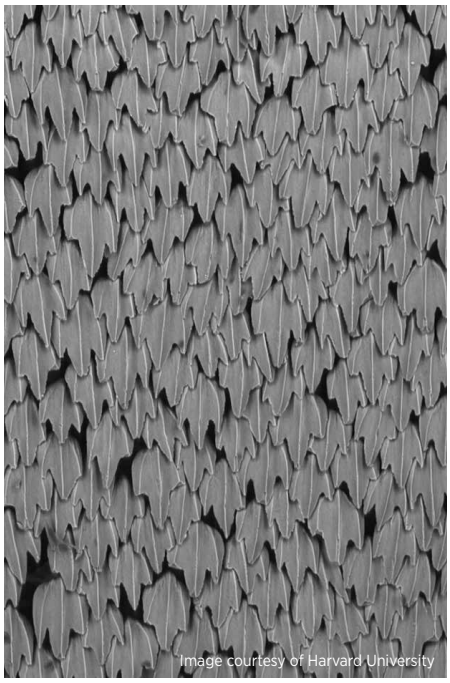


A CHARMING SPIDER

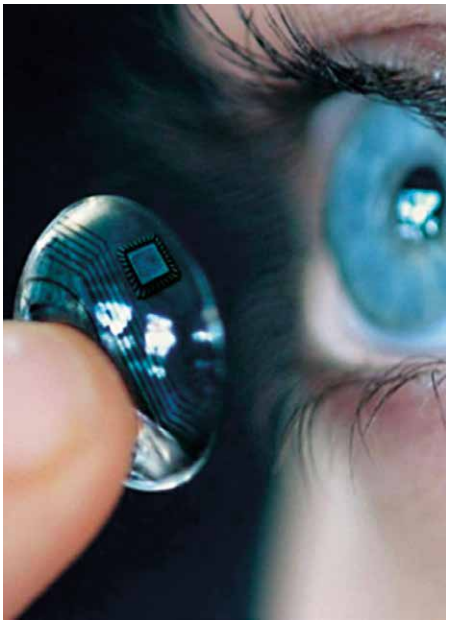
The males of the Maratus Robinsoni species or Rainbow Peacock spiders use an incredibly romantic means to entice females: by displaying a rainbow on their back. An international multidisciplinary research team was highly intrigued by the intense iridescence displayed on such a tiny surface as their body. Understanding and reproducing their structures could contribute to considerably reducing the size of spectrometers, namely for aerospace or chemical detection applications.

SHARKS WILL SEND US FLYING

Most studies on the aerodynamic characteristics of shark skin have been focusing on its capacity for reducing drag. However, a Harvard University research team has discovered that the tiny denticles that it is made up of also increase lift by generating high-powered micro-swirls. By modifying the airflow on the surface of a moving object, they increase its aerodynamics by up to 323%. If used on drones or wind turbines, vortex generators inspired by shark skin could dramatically improve the efficiency of the blades.



▲ Detailed view of shark skin



THE RETURN OF CONTACT LENSES FOR DIABETICS?

South-Korean researchers have designed smart lenses capable of monitoring blood sugar levels in tears. What's interesting is that Google and Novartis started working together on a similar project a few years ago, which they seem to have abandoned once and for all. The new Korean version, which has yet to prove itself, has embraced recent progress in nanotechnology and it could very well change the life of people with diabetes: no more finger-prick testing and once the glucose level is measured, the results would be transmitted to the user through an LED display!

HIGH POWER

THAT KEEPS COOL

By Renzo Monti

Transmitting high power through a small, lightweight connector that does not overheat: LEMO has taken up the challenge and will launch the resulting product this summer. It's been optimised for power efficiency and therefore it could very well become a crucial component of any electric vehicle.

It all started with a simple question raised by the representative of a major Formula One racing team in the summer of 2017. Just like all F1 teams, the car is equipped with a kinetic energy recovery system (KERS) that recovers and stores power during braking and releases it under acceleration. To connect the battery to the system, you need high power cables and connectors and these are typically heavy, large and not very efficient. The customer, who uses LEMO M-Series connectors for electronic control units, asked quite naturally: *"Do you happen to have the same, but in a high-power version?"*

Billy Barbey, LEMO's R&D and Product Support Manager took charge of the project. *"The M Series was named 'M' like Motorsport, since these connectors were originally developed for motorsport,* he recalls. *However, they were developed for use on the car's electronic control and monitoring systems and therefore we did not need a high-power handling capability."* So, it was necessary to keep all the characteristics that make the M Series the ideal connectors for race cars: lightweight, small in size, easy-to-use, robust, watertight, reliable and absolutely safe and develop a new insert and contact to extend the range to capture this new high-power handling requirement.

Once the design was outlined, it went into the test phase. *"The connectors were put under load and the performance monitored by means of thermocouples and thermal imaging cameras and by completing an iterative process the performance was optimised"* says Billy Barbey. Initially, standard off-the-shelf contact technologies were used on the project, however, after many tests it became apparent that these basic designs had performance limitations, even if the contact features and materials were optimised.

For this project, LEMO decided to develop its own contact technology, a first in the field of high-power and something that could be used to revolutionize the complete range of connectors.

The prototype, now being in the characterization phase, is able to transmit 250 amperes through a 25-mm^2 cable, which is sufficient to meet the Formula 1 KERS requirement. It is also enough to attract attention: upon learning about these excellent results, the Formula E world – the electric version of Formula One – has shown a lot of interest in the product. This raises the bar even higher, as the battery power is the only source of energy and the connectors need to handle up to 350 amperes!

"What started off originally as a simple adaptation of a product has now become a highly innovative addition to our product range", notes Serge Buechli, marketing manager. Currently a custom product, the new high-power connector will be developed in several versions. It will be used in motorsport, but also for the power supply of fast developing markets, such as drones. *"Drones designed for surveillance or for parcel transport have to be highly robust, watertight and resistant to cold,* explains Serge Buechli. *Drones are not gadgets or toys anymore. Our new connector, capable of transmitting a lot of current in complete safety, seems to be the perfect choice."* |

▲ The new connector in the eye of a thermal camera

SMART HEALTH

Improving health and preventing death – a quest as old as humanity, that has progressed hand in hand with technological innovation. Today, miniaturisation, robots and the growing wearables market have a huge impact on healthcare and medical secrecy. Here is an overview of some very smart solutions.

PRECIOUS UNCONTROLLABLE MEDICAL DATA

An estimated 150,000+ health applications are available in the app stores that have been downloaded billions of times. The health tracker market has been soaring these last few years. Every single minute, enormous quantities of sensitive health data are collected, shared and stored, with a much lower level of protection than that required from healthcare institutions. Here is our unencrypted interview with a specialist.

THE SPECIALIST

Name: Pierre-Mikael Legris
Computer engineer, entrepreneur
Founder and CEO Pryv SA
Age: 41
Nationality: Swiss/French
Married, 4 children

Pierre-Mikael Legris, let's start from the beginning: what is medical data? Is the number of steps or floors climbed also considered as medical data?

Originally, medical data were those recorded by medical staff on medical devices – heart rate, weight, blood sugar level, etc. With the growing number of personal health trackers, we need to give a wider scope to this definition. To me, all data used by a doctor to evaluate a patient or to decide on treatment is medical data. If the number of steps you take is considered by your doctor, then that becomes medical data as well.

It is very broad…

Indeed. We can imagine a doctor asking his patients about what they watch on television in order to better assess their psychological condition. In such a case, television programmes can be considered as medical data! Tracking the location of a person can also be considered as such, if, for instance, it helps a doctor to advise a patient on how to go to work by avoiding areas that are full of allergens that he is sensitive to. From my point of view, it is how the data is used that determines its medical status, more than its nature.

Doesn't your definition blur the boundaries between medical data and life data?

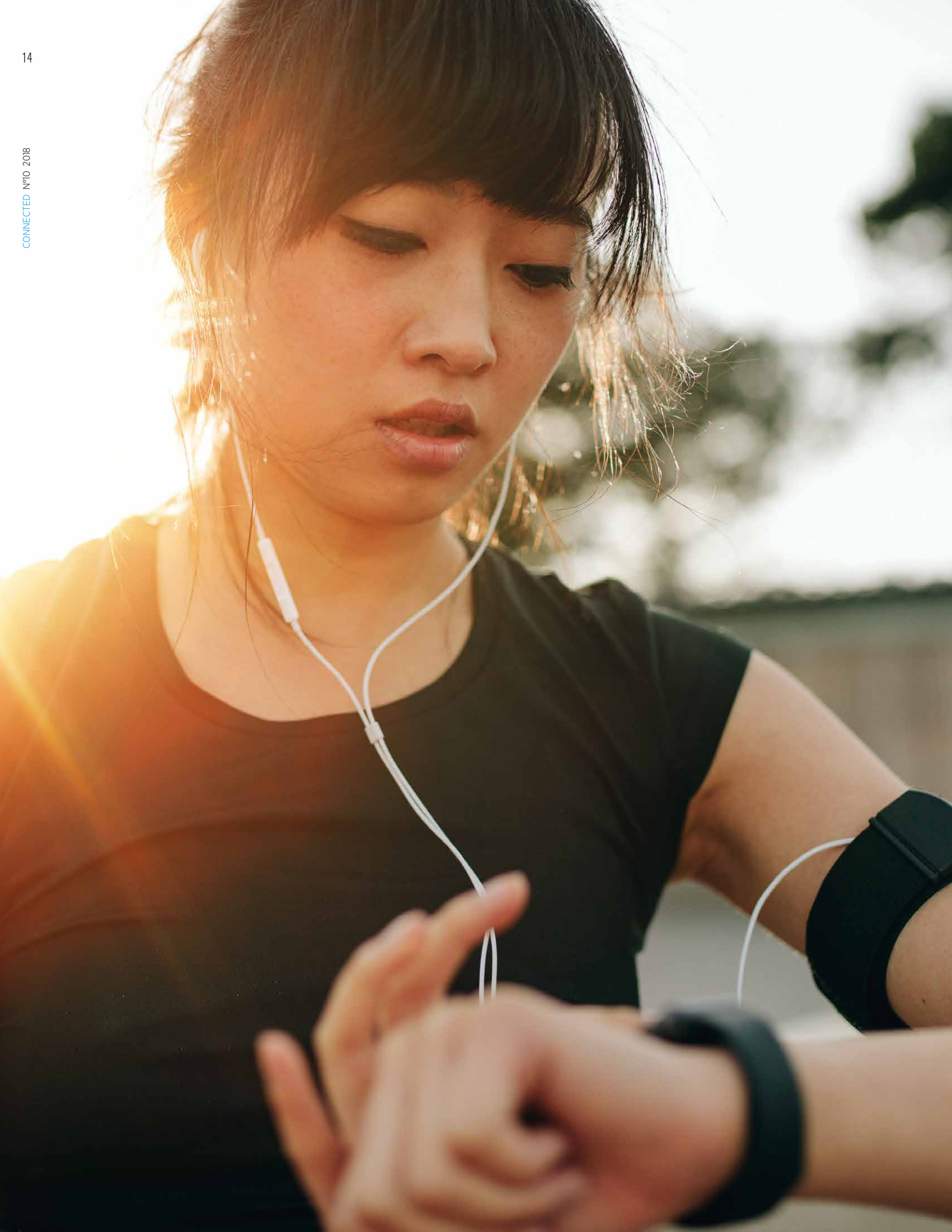
Maybe it does, but these boundaries have never really been clear. For example, as far as data protection is concerned, European law (GDPR) makes a less and less clear distinction. Rightly so: there is no reason to better protect one or the other, since life data – such as all the places you went to last month – can be just as sensitive as medical data.

Do you think people realise how valuable medical data can be?

I think they do. On the other hand, it is harder for them to be aware of their level of protection. The moment they share such data, they don't necessarily have the choice. When a person wants to show something to his doctor or when two doctors need to share information about a patient, either they meet, or they use the most practical means of communication available: e-mail, WhatsApp, etc. For sure – and it was proven by Pryv (see page 15) – if you provide these people with a practical secure solution to send data, they will use it quite spontaneously. However, when they haven't got one…

Users may also think that health data recorded by an app are protected, which often isn't the case. According to a survey conducted in USA, for example, diabetes apps often share data with third parties, there is not even any legal protection against the sale or disclosure of such data and 81% of these apps don't even have a privacy policy!

We seem to be very worried about theft, but the main cause of data leakage is by far the fact that people use services that don't guarantee any security at all. Or else they have accepted



the general conditions (GC) without realising that they have agreed to sharing their data!

So, is it the users' fault?

It would be their fault if we deemed that users are actually able to understand the general conditions. Yet, I think it is humanly impossible to read and understand the GC of services that are submitted nowadays. They are way too complex, too long, too many. These GC are the joke of the century. People need to understand the conditions, otherwise it isn't fair.

Are there any fairer practices?

They exist, but they are obviously more complex than simply checking the box "I accept the GC"! Some are pedagogical: users have to fill in a questionnaire that checks how much they know about what, when and with who is going to be shared. It is only after they have answered the questions that they can accept the GC, so, in such cases, we can talk about informed consent. Another possibility – that we have chosen with Pryv – is to replace general conditions with dynamic conditions.

Meaning?

Rights of access and sharing are not decided upstream and globally, but at the moment the choice has to be actually made. Just like when your smartphone asks "This app would like to access your camera, do you accept?". This can also become burdensome. For example, a doctor would need to ask for your authorisation every time he would like to share your data with a peer. We would need to be able to give access "to doctors only", but this type of authorisation does not exist yet.

Being able to decide about sharing doesn't turn us into owners of these data…

No, data proprietary rights have not yet been legally established. However, data protection law is becoming more precise and is better applied as far as rights to access, control and delete are concerned. If it is about your personal data, you should be able to consult, see who has access and even request deletion.

Or even benefit financially from the use of my personal data!

It is a recent idea that was born with awareness that companies were transforming our data into commercial products. It is quite simple: if companies make profit by using my data, just like banks benefit from investing my money, why wouldn't I earn interests, just like from my bank? I don't know whether this idea has any chance to be applied one day. Meanwhile, users do not get anything in return for their data, apart from the right to use the services provided. It is even more so with free apps, which finance themselves by selling data. This is what the well-known saying refers to "If you are not paying for it, you become the product."

Data usage does not seem to provoke strong reactions as long as it stays anonymous and is used for average calculations…

…because it doesn't affect user privacy and its usefulness is easy to understand. It helps device or apps designers to understand how they are used and so, to improve them. It can reveal public health tendencies, such us mobility depending on age. It helps insurance companies to establish reliable low risk models and so to propose insurance coverage at the best prices.

PRYV OFFERS TURNKEY PRIVACY

Health data came into the life of Pierre-Mikael Legris, founder of the digital privacy start-up Pryv, at an early age and for reasons beyond his control.

Diagnosed with leukaemia at the age of 28, he spent a lot of time in various hospitals, with a host of doctors – at a time when medical data wasn't recorded electronically. *"I found myself to be the custodian of my own data,* he tells us. *I had plenty of small notebooks in which I wrote down everything doctors asked me to note – my temperature, what I ate, my weight, my physical activities… – and much more."*

As years go by, medical treatment and follow-up continue. Meanwhile, Pierre-Mikael Legris, who became an IT specialist, imagines a data model that would make record keeping and sharing easier. He teams up with others who dream about developing a Facebook guaranteeing data proprietary rights and ensuring that their data are used on a voluntary and transparent base. The project, launched in 2012 has changed its business model since then. It has become a B2B solution: Pryv.io, a Swiss Made data and privacy management software.

Pryv is a middleware intended for all companies working with personal data: health tracker designers, insurers, electricity suppliers… *"It is extremely complicated to develop GDPR or HIPAA certified software for medical applications for example. We provide these companies with a ready solution that manages data collection, storage and sharing with access control. It makes them save 18 months of development!"*

The solution regroups data from multiple sources (for example from several applications or health trackers). *"The users can see all the data, just like with an online banking system."* They control sharing, giving selected access to a selected partner (doctor, hospital…). They can then withdraw these access rights whenever they decide to do so.

Pryv.io's "privacy first" approach is rather timely: the legal trend on personal data protection goes towards more transparency, more control by the user, more targeted access, given in full knowledge of the situation, compliant with highly demanding security standards. Pryv helps companies achieve such requirements.

Since its creation, the start-up has won several recognitions in Switzerland. It has also been selected by Microsoft in spring 2017 to join its BizSpark Plus Program (with a $120,000 Microsoft Azure credit over two years). Last October, Pryv announced a capitalisation of 1.1 million and launched its Series A "Growth" funding round which is expected to be closed by Q1 2018. | Nicolas Huber

On the other hand, there is a very strong sentiment against the idea of using data associated to the source person...

This is obvious, since in this case, we talk about direct and undeniable privacy invasion. This is intimate data. The idea that certain companies learn about my blood sugar or the number of steps I take on a Wednesday morning is annoying. The idea that they use this data to sell me their products via targeted publicity is even more so!

A common concern is that insurers get hold of individual health data and that they use them for applying extra premiums or even refuse coverage...

There is such a risk and we should trust legislators to ban such type of data use. For the moment, however, it is quite the opposite: insurers have supported the use of health devices and apps not with the aim of knowing and using their clients' health data, but because it had been proven that people monitoring themselves take better care of their health.

"The General Conditions of digital services are the joke of the century"

In fact, you seem to believe that the real issue is more about respecting individual choice rather than health data security.

Yes, indeed. There is often a confusion between security and privacy, even though they are quite different: security means the thickness of your front door, privacy is about the keys you give to your relatives for getting in. Today, data security should be maximum everywhere. Users should not need to worry about anything but access and verifying that everything is done with their consent.

How about opting for maximum privacy every time?

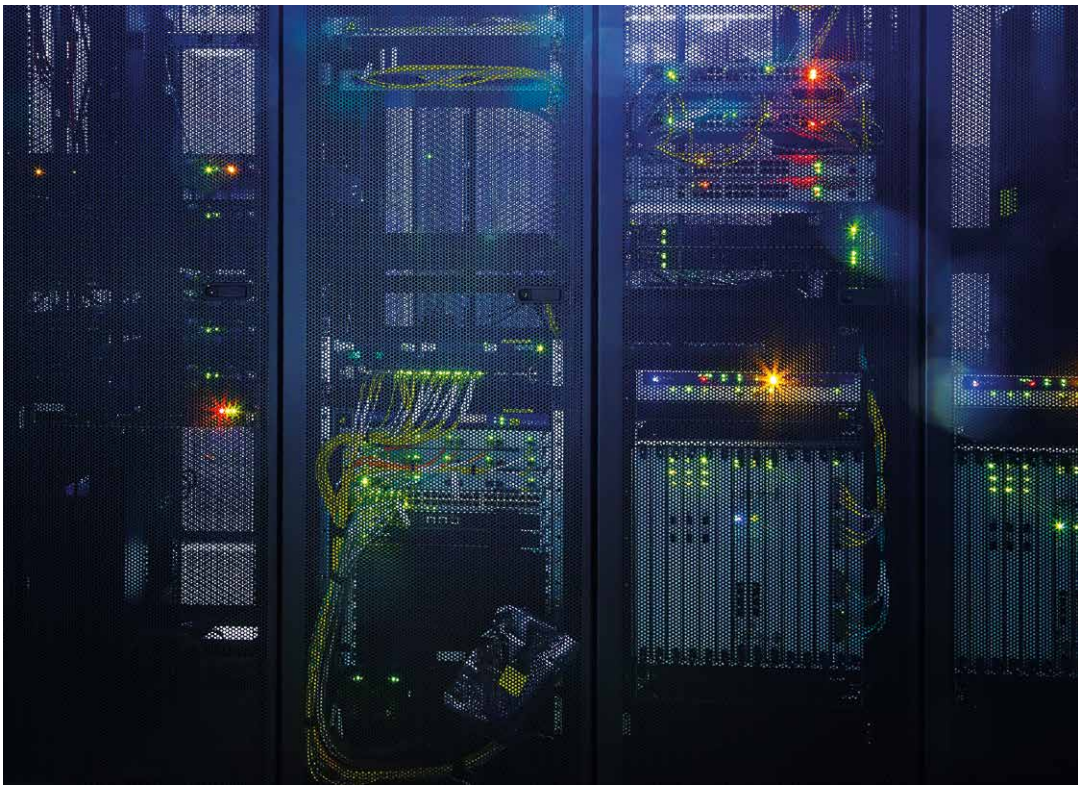
It isn't that easy! Maximum privacy can also be a problem. Imagine that you are the only one who has access to your medical records: it seems to be all right, except in case you are unconscious and rushed off for emergency care! We need to find a compromise: too much blocking may render your data useless, the contrary makes them vulnerable.

As for vulnerability: why choose to steal health data?

Honestly, I don't see the point of stealing mass health data, unlike bank data or classified information. What is their value? What could they be used for? On the other hand, if you are a rich and powerful person – a big business owner or a politician – a pirate could be interested in stealing your health data and threaten to disclose them, unless you pay a ransom. Similarly, it has already happened that pirates blocked hospitals' access to their medical records and wanted a ransom to "release" them.

It is an ever-changing environment where there is still a lot of work to be done to ensure data protection

Personal health data networking is very recent, just like the widening use of health apps and personal trackers. Information science and technology have been progressing and changing very fast, so have rules and regulations, but at a slower pace. We are still a bit like in the early days of the automobile era, when there were only a few traffic signs and the highway code was only a page long. | Interview by Nicolas Huber



THE SMART NEEDLE THAT "SEES" WHAT DOCTORS CAN'T

It looks like an ordinary needle, yet it knows precisely what body tissue it is passing through as it punctures. Finnish start-up Injeq's IQ-Needle will save time and costs, while improving safety and comfort for patients.

A child with leukaemia receives approximately 20 lumbar punctures during a typical course of treatment. While these punctures are necessary, everyone of them poses a risk.

Currently, lumbar punctures are performed blind – the clinician must go "by the feel of it" to know when the needle has reached the cerebrospinal fluid (CSF) and should not be inserted further. Punctures often fail and must be re-attempted, especially with the tiniest patients. About one in five causes tissue damage that can impact outcomes for children with leukaemia.

"When physicians perform lumbar punctures for leukaemia patients, they go very slowly and carefully. They frequently take out the stylet to check where they are, which raises infection potential, explains Injeq CEO Rami Lehtinen. *Worse, if you go too deep, you can introduce blood into the spinal fluid. Since leukaemia is a blood cancer, there is a risk of spreading it into the central nervous system. Our IQ-Needle makes punctures easier and more accurate, greatly reducing these risks."*

The Injeq IQ-Needle system is comprised of a single-use IQ-Tip Spinal Needle and an Injeq 301 Analyzer. They are connected by a LEMO-Northwire connector-cable harness – which was selected because it is robust enough to be autoclaved frequently throughout its life cycle.

The Injeq IQ-Tip contains a probe stylet that tells what kind of tissue the tip of the needle is touching in real time. It does this by measuring bioimpedance – the level of resistance to an electric current – which is unique for every tissue type. As the puncture is being performed, the INJEQ 301 Analyzer takes measurements 200 times per second at 15 frequencies. There is an alert tone when the needle has reached the CSF.

With Injeq technology complementing the physician's skill, punctures are safer, faster and cause less discomfort – all of which support better patient outcomes and healthcare cost savings.

▲ The Injeq 301 tissue analyser identifies the tissue at the tip of the Injeq IQ-Tip needle in real time. The device is connected with a REDEL SP connector and a Northwire cable.

Injeq's is a classic start-up story, beginning with the recognition of a need. In the early 2000s, three researchers in Tampere, Finland thought, "if only we could make demanding punctures safer..." Over the years, they kept the vision alive and Injeq was founded in 2010. Work began in earnest towards a commercially viable smart needle.

"We've been doing clinical trials in Finland for about two years, says Rami Lehtinen. *We are now expanding to a multicenter study including every Finnish university hospital and three other university hospitals in Nordic countries."*

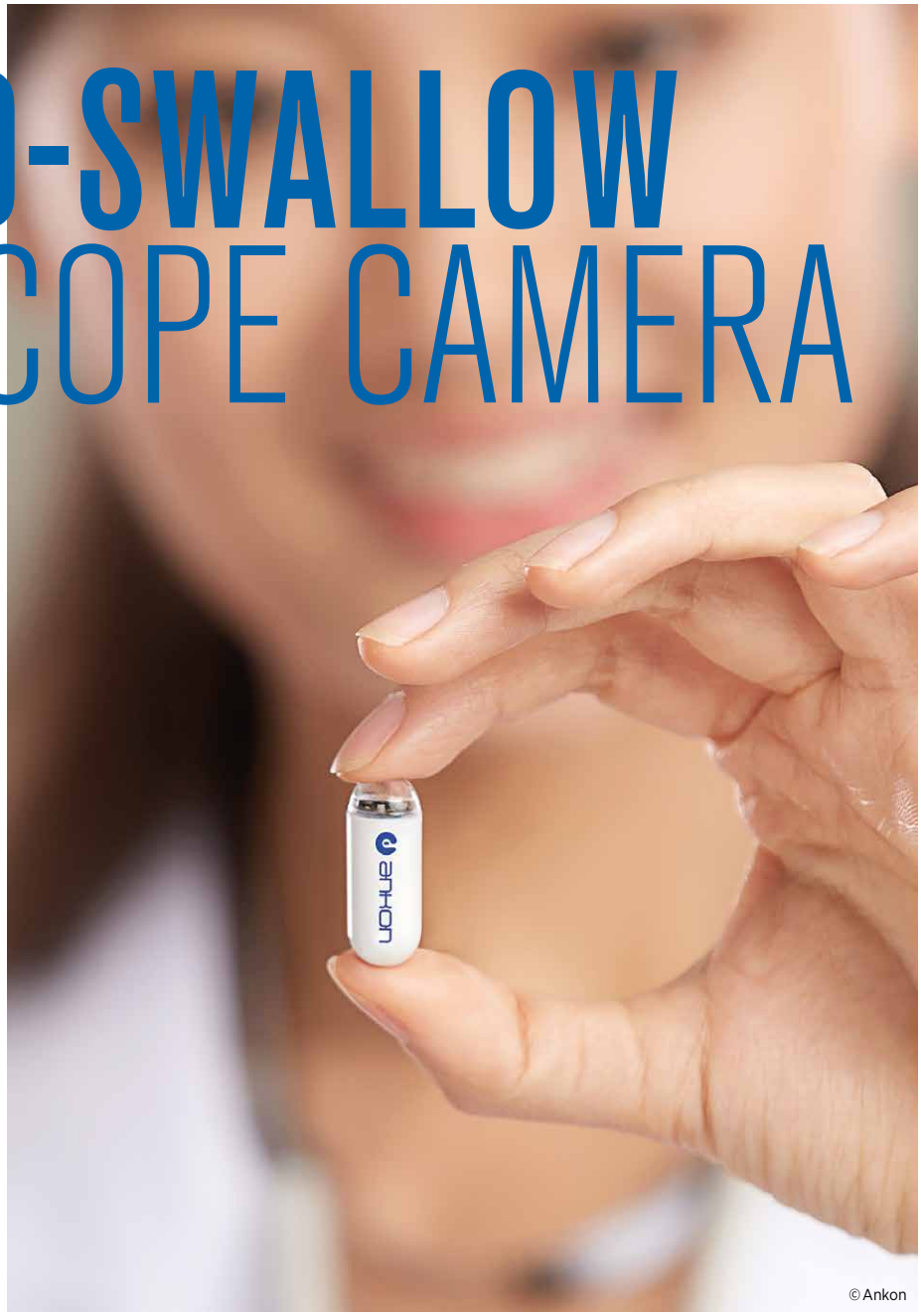
The company expects to receive CE certification during 2018 and launch commercially in Europe. Next steps will include another funding round to launch beyond Europe. Injeq will first market the smart needle for pediatric leukaemia and neonatal ICU patients, then for adults and spinal anaesthesia. Numerous other applications of Injeq technology, such as biopsies and drug delivery, will follow.

"Whatever type of demanding puncture you do, you like to know where the tip of the needle is, says Rami Lehtinen. *We selected the spinal needle for the first application because there is great immediate benefit to patients and because there is nothing like this out there."* | Sheena Kennedy

"Our system makes punctures easier and more accurate."

Rami Lehtinen, Injeq CEO

EASY-TO-SWALLOW ENDOSCOPE CAMERA



▲ Over 300 components are fitted into this 27 × 11.8 mm smart pill.

Miniaturisation has not only upgraded our telephones into PCs and helped secure our homes like perfect James Bond hideouts, it has also revolutionised healthcare, by providing treatment and life-saving solutions which were inconceivable just a few years ago. The NaviCam capsule is a fascinating example.

Shanghai-based ANKON Medical Technologies brought together a pool of experts from various backgrounds, including doctors and engineers specialised in materials, micro-electronics and imaging to create this small gem. The result is a capsule made up of a tiny camera, that the patient simply swallows with a glass of water. NaviCam revolutionises endoscopy by ensuring a truly non-invasive stomach examination. We can at last forget about uncomfortable and intimidating traditional intubation.

What does NaviCam look like? Imagine a 27 mm long, 11.8 mm wide capsule, with a volume of less than 3 cm^3. Incredibly, this miniature device contains over 300 components, including a camera, a wireless signal transmitter, an LED light source and a magnet!

Capable of navigating in all directions, NaviCam can explore the slightest nooks and crannies of the gastric cavity without any blind spots. It is controlled by an external guidance device through a magnetic field communicating with the capsule's magnetic sensor. It takes about 15 minutes for the remote-controlled capsule to move through the digestive tract, following the doctor's instructions and to take thousands of images at two frames per second. Once its mission completed, the single-use capsule continues its way through the lower digestive tract and is naturally discarded.

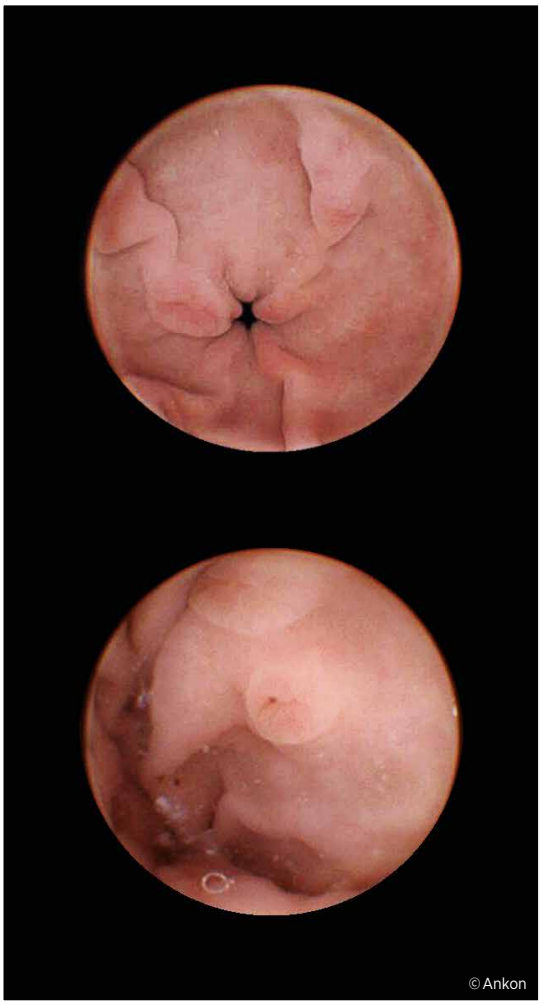
In order to improve diagnosis, the images are downloaded during the examination onto a secure Cloud platform, accessible to over 400 specialists. The on-site physician and the patient can thus rely on external support for identifying any possible gastric condition or tumour.

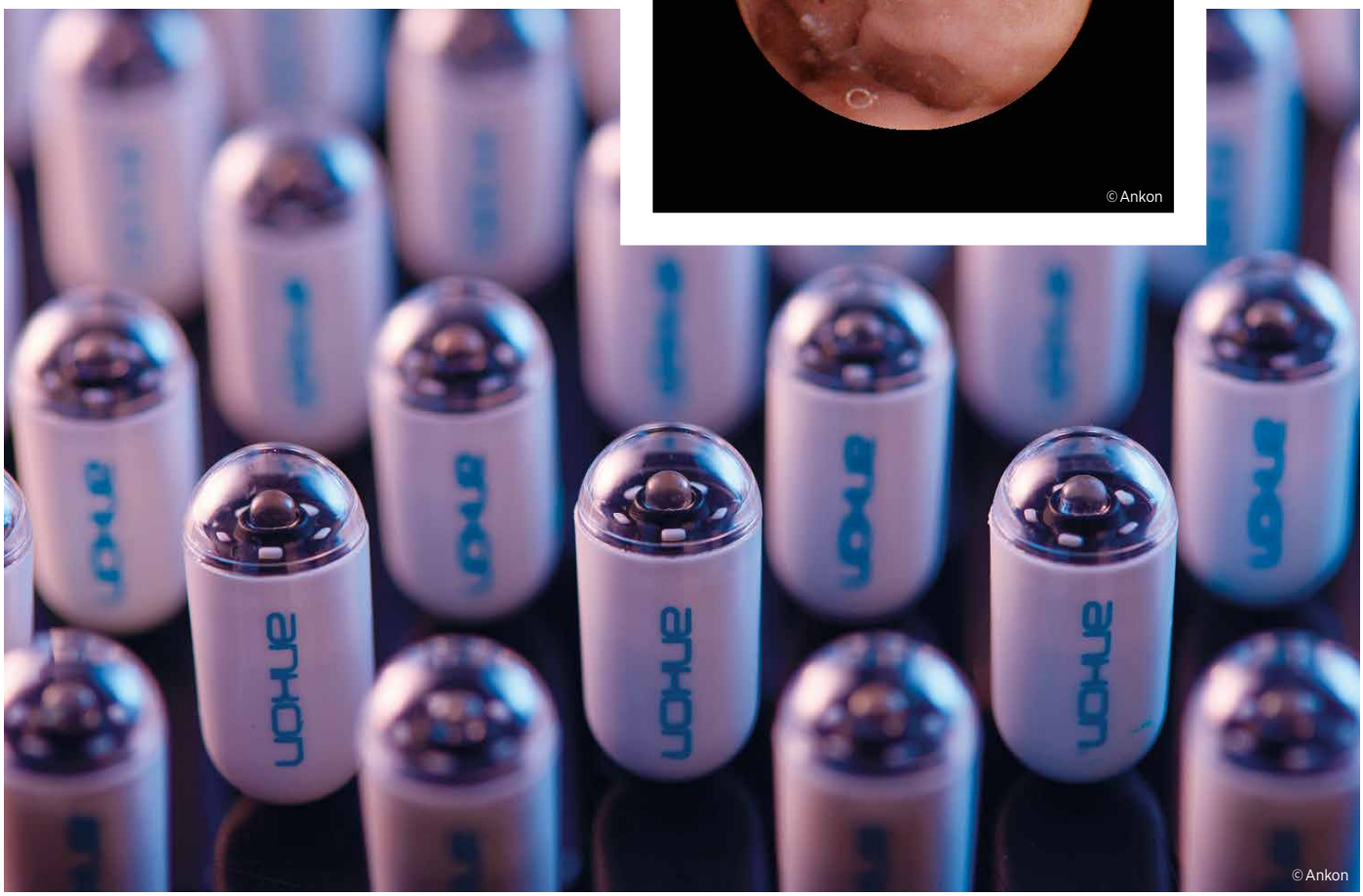
In addition to robot guidance and miniaturisation, creating such a device involves other challenges, such as how to make it resistant to acids and alkalis contained in the digestive tract, or how to ensure that it is harmless to the body. For this reason, NaviCam is covered in a layer of biocompatible polymers. It can then guarantee painless gastroscopy with no need for anaesthesia.

In China, where it was designed, NaviCam has been hailed as a major breakthrough. It won the 2016 China Top Ten Medical Progress Award and has already been introduced into almost 1000 medical analysis laboratories in 30 Chinese provinces and cities.

Through this invention (fitted with LEMO's RR series connectors), gastroenterologists are hoping to reduce the high incidence of stomach cancers, an illness with one of the highest rates of increase in China, often diagnosed too late because of the test methods being considered too invasive by the patients. Armed with this simple and comfortable technology, they will be able to reverse the current trend of mortality and prolong the lives of many people. | Alexis Malalan

▼ Through its camera and light source, Navicam captures clearly legible images





▲ Ankon is aiming at making endoscopy much less uncomfortable for millions of patients.

▲ Globus Medical's ExcelsiusGPS with its robotic arm

THIS ROBOT HAS YOUR BACK

Globus Medical, an expert in the field of musculoskeletal solutions, has invented an innovative solution to the challenges of spinal surgery. Its Imaging, Navigation & Robotics division has developed ExcelsiusGPS, a robotic navigation platform that assists spine surgeons during surgery. The robot is considered as a major breakthrough by the company based in Pennsylvania (USA).

This ExcelsiusGPS is a revolution in robotic spine surgery which is designed to improve accuracy and optimise patient care by using robotics and navigation, much like a GPS in your car.

On the day of surgery, medical images are taken and imported into ExcelsiusGPS. The surgeon uses these images to determine the size and placement of implants and creates a patient plan based on the patient's anatomy. This is used to guide the rigid robotic arm to a specific region of the spine, similar to a planned route or pathway on a GPS. The surgeon uses this pathway or route to accurately place the implants using navigated instruments. Throughout the procedure, the surgical instruments and implants are continuously displayed on the screen for the surgeon and staff to visualise.

The system is designed to enable minimally invasive surgery which combines the surgeon's understanding of anatomy with X-ray imaging to treat spine conditions using only minor incisions. A minimally invasive technique enables the surgeon to separate the muscles surrounding the spine rather than cut through them and to operate through small incisions along the spine. This process has many benefits, including shorter hospital stay, less tissue damage and smaller scars.

ExcelsiusGPS carried out its first operation on 4 October 2017 at John Hopkins University in Baltimore. | Alexis Malalan

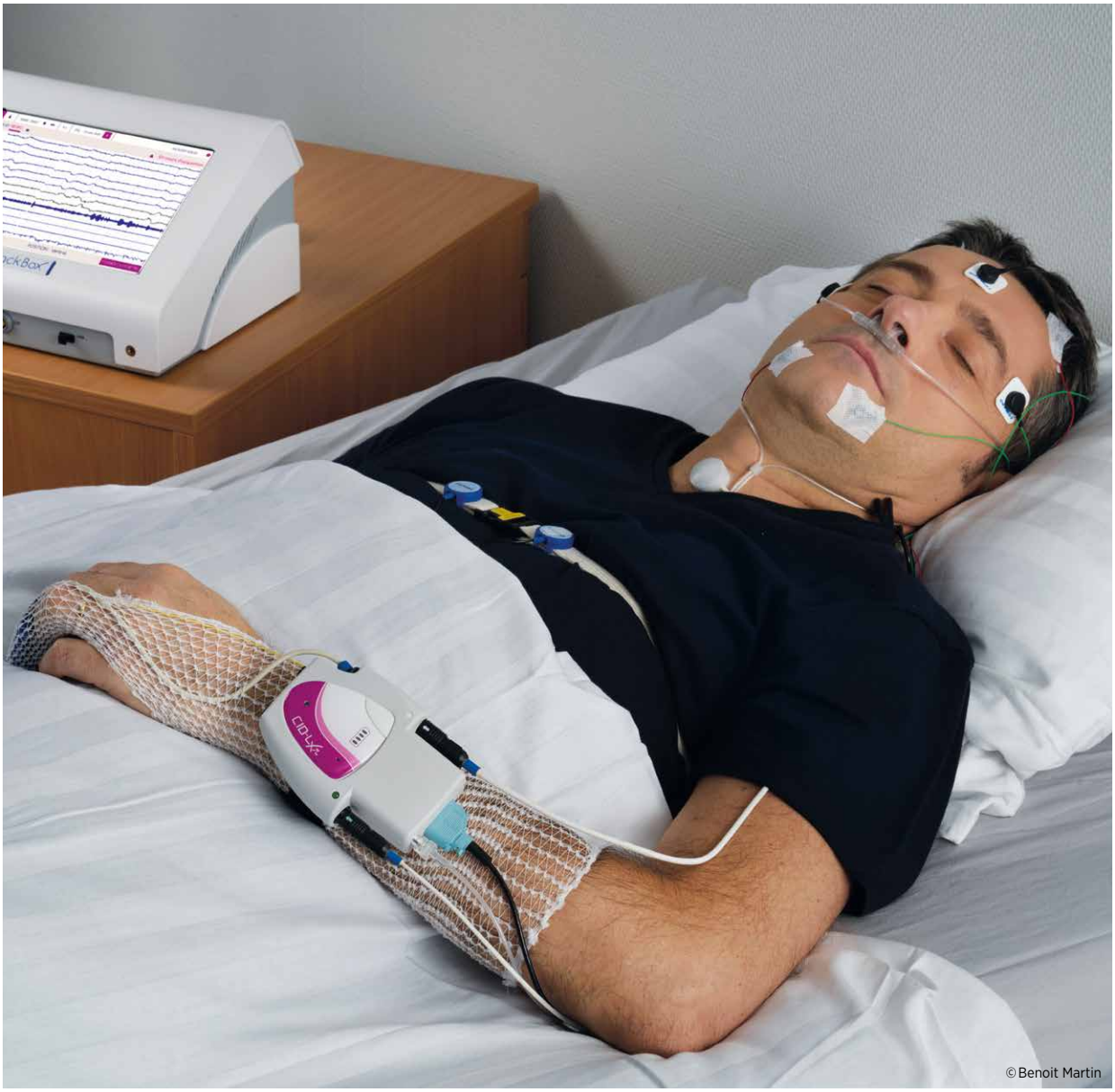
SLEEP TIGHT WITH CIDELEC

The importance of sleep for well-being and health is a proven fact. Unfortunately, bad nights can have a countless number of causes. Among these, sleep disordered breathing affects one person out of twenty in western countries. They have an adverse effect on overall health and can considerably increase the risk of a heart attack or a stroke. Not to mention the inconvenience they cause to the person (not) sleeping next to them...

Sleep apnoea syndrome (Pickwickian syndrome) was described in 1956. The description of sleep disordered breathing was launched in the sixties. Research passed a milestone in the late eighties when cooperation between the Sleep Laboratory of the University Hospital of Angers and the ESEO Electronics Research Laboratory resulted in a brand-new technology designed to detect respiratory events (apnoea, snoring...) by tracheal sounds. For patients, it gives the benefit of avoiding the use of invasive sensors for diagnostic recording. The innovation was patented and it led to the creation of the company Cidelec.

To this day, their technology remains unique, since it is the only one capable of recording three physiological parameters with a single sensor stuck on the skin above the trachea: mouth and nasal breathing, respiratory effort and snoring. In addition, it can analyse the resistance of the upper airways (pharynx) by measuring acoustic intensity.

Cidelec, who have become the French leader in the field of sleeping disorder diagnostic equipment, develop all their solutions based on this technology called PneaVoX.



▲ Patient monitoring using Cidelec's new Smart-PSG

Among these are portable polygraph ventilators to diagnose sleep disordered breathing. Combined with thoracoabdominal straps and other sensors (oximeter, nasal cannula, brightness sensor, etc.), polygraphs can detect and characterise sleep apnoea syndrome, whether obstructive (mechanical obstruction of the airflow in the upper airways) central (when the patient forgets to breathe because the brain doesn't send a signal to the body to do so), or mixed.

Portable polysomnographs are used when other factors (neurological in particular) may also be involved in the sleeping disorders. In addition to respiratory data, they are capable of recording 8 further electrophysiological parameters: brain activity, muscle activity and eye movements. Reaching beyond PneaVoX technology, Cidelec polysomnographs feature another unique benefit: they are the only ones to be fitted on the wrist instead of the thorax, so that patients can sleep on their stomachs if they wish to.

Cidelec can provide sleep labs with polysomnographs that can record and visualise in real time all respiratory parameters up to 24 electrophysiological parameters. They are currently designed as fixed devices equipped with a video, connected via a cable to a case at the patient's bedside, who is also connected via a cable to the technical monitoring room.

This year, Cidelec, a LEMO customer, will offer an innovative version called "Smart PSG" using tactile wireless technology. Medical staff monitoring will be further facilitated and patient comfort will also improve, with free movement made possible during night observation. | Corine Fiechter

TECHNICAL INNOVATION

REVOLUTIONISES DISABILITY MOTORSPORT

All images by
Kingsize Photography

The Team BRIT car racing team are getting ready to send off their disabled drivers to the 24 Hours of Le Mans race. This is a historic event that needs as much courage and passion as technical expertise. LEMO is a partner of choice.

For years Britain has led the way in all things disability. Disability laws, acts around discrimination and setting the standard for accessibility and equality have begun in the UK. Similarly, Britain is a leader in motorsport. McLaren and Aston Martin, for example, have earned their status as iconic British heritage brands with quality and technological expertise at their core. So what happens when you bring these two areas together? Team BRIT.

Team BRIT is a motor racing team consisting of drivers who are disabled. It has set out a hugely ambitious target of being the first ever all-disabled team to compete in the world-famous Le Mans 24-Hour endurance race, a feat they wish to achieve by 2020.

Following a high profile launch in February 2017, supported by title sponsor Brit Insurance, the team has gone from strength to strength, running two cars in the UK's Fun Cup championship – the first rung on their motorsport ladder. This year 2018 will see them move up to GT4 racing, whilst continuing to offer new rookies entry level racing in the Fun Cup, creating an academy model of motorsport.

The team's drivers each have varying disabilities that affect their physical mobility in different ways. The majority are ex or serving military troops that have sustained injuries during their time in service. Recently the doors were opened to civilian drivers in an effort to widen opportunities.

Technology has been the key to making this a viable project. The team has developed the world's most advanced hand control system to allow its drivers to seriously compete on a level playing field against able-bodied drivers.

Previously, disabled drivers would have used mechanical push-pull or radial hand controls. Team BRIT's system uses 'drive by wire' technology for the brake, throttle and clutch. To control and monitor these pneumatic and hydraulic systems there's a vast array of electronics, and the team have been working with LEMO UK to make this happen.

Team BRIT Chief Technician Al Locke said *"Reliability is key. The races in which we compete are typically anything from 4 to 25 hours in length, and it's a real test of every part of the car. In such a harsh environment the clear leader for us is the LEMO M-Series connector. We use B, M and T series connectors extensively throughout all the cars. Their ease of installation, ingress protection and mechanical strength is second to none."*

The team looks to serve as a pioneer for wider change in the automotive industry when it comes to disability. *"With LEMO CEO Alexandre Pesci's racing pedigree through his LMP* program it was only natural that we'd want to work with LEMO"* says Team Founder Dave Player, who serves as the Disability Advisor for the Federation Internationale de L'Automobile – motorsport's international governing body. He is an influential member of their recently established task force to improve access to motorsport for disabled people and is looking to spread the use of this technology globally.

LEMO continues to support the team through the provision of connectors and engineering advice. |

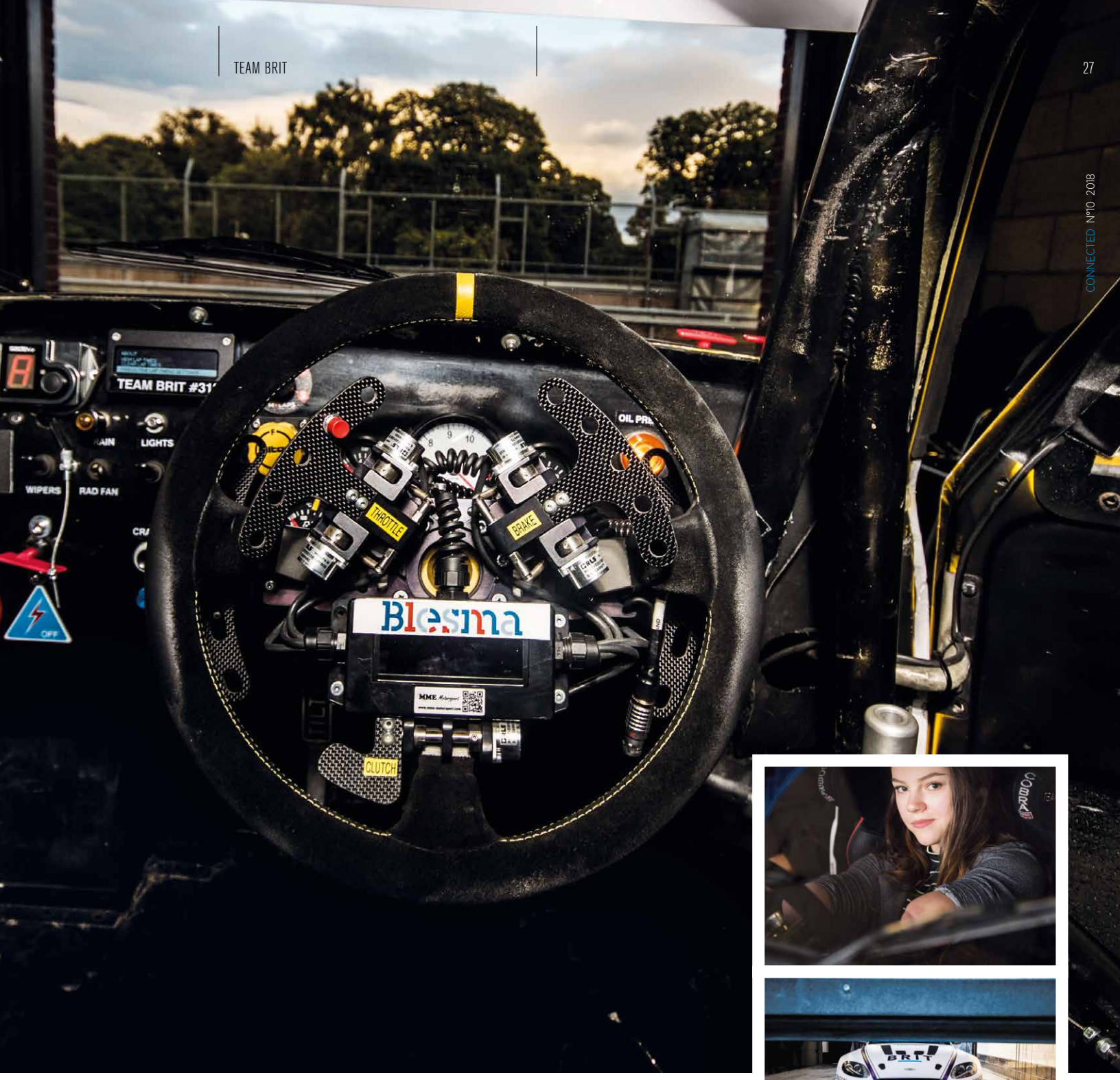
*Le Mans Prototype, a type of prototype race cars that run in the mythical 24 Hours of Le Mans. LEMO has a strong presence in car racing, namely in LMP, in Formula E (see also page 8) and Formula 1.

See www.teambrit.co.uk.

◀ Team BRIT Drivers

▲ Fun Cup Endurance Race – Silverstone UK April 2017

Damon Hill, former F1 champion, fully supports Team BRIT



"The team has developed the world's most advanced hand control system to allow its drivers to seriously compete."

A NEW GOLDEN AGE FOR VISCOSITY

By Renzo Monti

▲ Fungilab's equipment has already received two major industrial design awards.

Fungilab, a leading manufacturer of viscosity equipment is about to announce a new series of innovations. Its success story continues as viscosity is becoming increasingly important in modern industry.

How is it possible that your favourite soft drink keeps the same flavour, the same consistency and lasts for so long, whether you buy it from a seaside supermarket or a grocery store in a mountain village? Or that your moisturizer keeps the same texture and fragrance for several weeks, even if you open and close the jar daily? How do you know how long the oil will last in your car before it needs to be changed?

Behind every such small miracle there is the same science: rheology, a science which studies the deformation and flow of materials in liquid or soft solid state. Among other aspects, viscosity measures the behaviour of fluids under one flow condition. The resistance of a fluid to changes in shape or how the internal molecular structure reacts to a force applied are key factors in understanding how to control fluids used for lubrication, spraying, injection moulding and surface coating or transported in pipelines, to name a few. The major challenge is to find the molecular structures that will keep these characteristics as stable as possible.

Fungilab, was founded in Barcelona (Spain) and has subsidiary offices established in New York, Panama and Taiwan, as well as a worldwide presence in more than 70 countries. It all started

Fungilab devices can be digitally connected.

in the mid-eighties, since when the business grew from a small domestic company into a global leader in viscometer manufacturing. Fungilab's equipment has already received two major industrial design awards (an IBO Award in 2015 and a Red Dot Award in 2016). The company is recognized as an international leader in the field of viscosity technologies and analyses.

Such devices include rotation, vibration and oscillation modes, all using a geometry which is compatible with each type of fluid, whether in contact or immersed in it. Measuring the torque required to rotate a disk or bob in a fluid at a given speed, the amplitude of a frequency or the energy needed to break intermolecular bonds are part of the technology and principles that Fungilab uses. These instruments are mainly designed for R&D and Quality Control departments as well as for industrial process areas.

"We study each request case by case. We are in contact with the most prestigious manufacturers and universities around the world to better understand their needs and how Fungilab technology can help them to improve the product, which, in the end, will benefit all of us" explains Ernest Buira, Chief Executive Officer at Fungilab.

"It is such a great honour to work with not only big companies, but also to help small businesses to grow and generate what will become the new product era in research. Such challenges include finding the solution to cure cancer with new drugs, introducing new clean chemicals, becoming more conscious of the environmental factors which act on an organism, a population, or an ecological community and influence its survival and development."

How come that such an important industrial field, having experienced its boom in the forties, has stayed so little known? *"It is a difficult science if you don't understand it,* answers the specialist. *And when people don't understand something, they tend not to pay enough attention! Molecular structures cannot be seen, but it is increasingly important to know what happens when force is applied to them. Moreover, rheology and viscosity are currently at a turning point in their history."*

In fact, viscometry has experienced unprecedented growth, because the composition of everyday products has become more and more complex. *"Paints are a good example. 20 years ago, it was quite a simple industrial field. Today, mixing has become rather difficult to control: security standards, various certifications, such as ASTM, ISO and other standards influence the composition of paints and so the characteristics of what can be sold or not."* Ecology has also become a major challenge: how to create plastic materials and make sure that they decompose to the same extent in various areas around the world? Only viscometry and rheology can provide answers to these questions.

In this new golden age of viscometry, Fungilab intends to reinforce its leading position. The company is about to launch a vast development programme of its product range. It could very well become the first company to be a leader in three major scientific fields: rotational viscometers, intended for quality control, which is Fungilab's current speciality; in process viscometers and scientific rheometers used in laboratories and R&D.

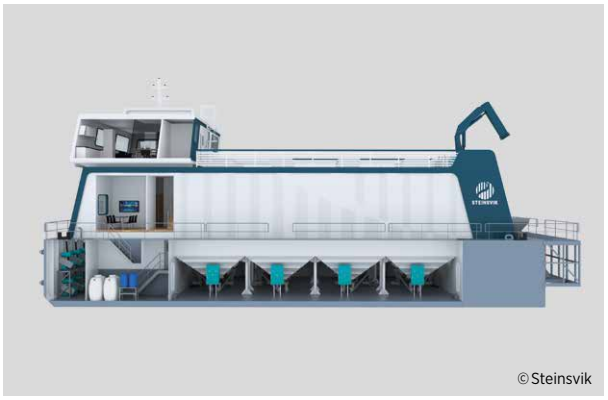
Another major step for these "serial innovators", already ahead of the competition thanks to a number of unique applications. In fact, all new Fungilab devices can be digitally connected for comparing results immediately and on a worldwide level. Whenever new functionalities, standards or calculations emerge, it will no longer be necessary to buy a new device, like it used to be until now: a minor update will be sufficient. |

HI-TECH FISH-FARMING: **OF LICE AND MEN**

By Corine Fiechter

Salmon consumption is soaring across the world. Whether land or sea based, fish-farming technologies are becoming increasingly sophisticated in order to meet demand with only limited environmental impact. Steinsvik is a leader in this field.

© Steinsvik



Side view of the Nova SideFeeder 600

Steinsvik's feeding barge, the Nova SideFeeder 600

Remote controlling and monitoring are possible

Aquaculture has existed since the dawn of time, but it's only since the seventies that it has become an exponentially growing commercial industry. In 2007, the global salmon production totalled 750 thousand tons. It has practically doubled to 1.4 million tons in 2017. Obviously, such growth involves sensitive issues, such as how to reconcile the increase in production with sustainability, safety and profitability? In order to find an equal balance, fish farms rely increasingly on innovative equipment and technologies like those offered by the Steinsvik Group.

Founded in 1966, the Norwegian company has built a solid reputation in the design and construction of feeding barges. A global leader in its field, providing significant benefits in efficiency and productivity.

With a food storage capacity of 150 to 850 tons, these automated platforms can be equipped with up to 16 feed lines. Depending on your needs, the barges are combined with software and other sophisticated equipment, including special cameras. Fitted with various measuring sensors, these cameras enable the monitoring of water conditions and fish behaviour to determine, for example, when the animals need to be fed. Ideal quantities for the well-being of fish are always maintained, which avoids waste and preserves resources.

Steinsvik also develops highly efficient solutions for water treatment and filtering with the underlying purpose of contributing to a more sustainable aquaculture.

Among all the patented innovations, the flagship product has been, for the last couple of years, without a doubt, the Thermolicer. It has indeed to do with lice. As it turns out, you don't actually need to have hair to get them. Sea lice – tiny crustaceans – are naturally present in the sea. However, the high concentration of fish in farms facilitates their reproduction, so they have become the public enemy number one for salmon producers. Thermolicer was designed to provide an environmentally friendly solution to this scourge. As indicated by its name, it uses heat and not medicine or chemical products.

It is based on a simple principle: the fish are aspired into a warm water bath of 30 to 34 °C where they stay for only about 30 seconds before they are let back into their cages. The sudden increase in temperature triggers the shedding of any attached sea lice from the salmon's body. The water is then filtered, aerated and oxygenated before being re-used in the system.

Capable of treating up to 80 tons of fish per hour, since its launch 5 years ago, Thermolicer has helped millions of tons of salmon get rid of lice. It has been growing in popularity and is used in all the major fish farms in Norway – the world's largest salmon producer – as well as by other major producers, such as Scotland, Canada and the Faroe Islands.

With growing production, centralised monitoring has also become increasingly important. Steinsvik provides high performance solutions fitted with fibre optics connections.

The company offers complete network infrastructures for remote controlling installations. Flexible and adaptable to the customer's needs, it could just as well equip a small fish farm in Tasmania as it does the world's largest fish producers. |

WHEN FRENCH TECH MET LEMO TECH

1908

By Corine Fiechter

Founded 30 years ago, LEMO France has become a preferred partner for many players in the French industry 4.0. The company supports the development of start-ups as much as major groups.

When LEMO's French subsidiary was created in 1988, its sole activities consisted of stocking and selling connectors. Among its early customers were major laboratories and other research institutes, very much in need of connectors for their test and measurement equipment.

Meanwhile, LEMO France has developed a highly diversified industrial customer base, from SMEs to major groups. Many of them are still loyal customers, such as a family company active in the automotive sector, whose technical director has treasured and kept LEMO's catalogue from... 1988!

The early 2000s were a major turning point for LEMO France, when in-house cable assembly was launched. *"Through this new activity, we were able to extend our services from connector sales to providing complete cable-connector assembly solutions, which represents an undeniable advantage*, explains Angel Moran, managing director. *Today, we have become even stronger thanks to Northwire cables."*

When Angel Moran took over the subsidiary's management in 2012, he put a strong emphasis on developing cable assembly activities, which grew from 2,000 assemblies in 2012 to 10,000 in 2017. *"We are now able to provide better service in terms of quality and reactivity and to position ourselves as a highly flexible local partner."*

This means a real competitive advantage at a time when France is experiencing a powerful momentum of relocation and industrial development, supported by voluntarist public policies.

French industry in general is reinvigorated, but "French Tech" is literally booming, especially as far as robotics and big data are concerned. Fairly active in these sectors, LEMO France supports not only large groups, but also small innovative start-ups that are also present in the medical, renewable energy and smart grids markets. *"In addition to LEMO quality, widely renowned in France, we are fortunate to be able to rely on the Group's solidity which also gives us the means for further development. At the same time, we remain a small structure with the agility of a start-up."*

The French subsidiary has grown from 3 employees in 1988 to 16 today, with a majority of women in technical positions. In order to support its development, the company has moved twice, but stayed in the Paris region. LEMO France's major growth opportunities include communication in sensitive or harsh environments: helmets, headsets, microphones, interphones for security forces and aviation.

LEMO France is equally active in many other fields, such as broadcast. Angel Moran recalls fond memories of the Group's 70th anniversary in 2016, celebrated by his team in the legendary Stade de France, where cameras had just been equipped with LEMO connectors for broadcasting the Euro football championship. A prestigious place and application to match the company's success story. |

LEMO

KEEP COOL AND BOOST YOUR ELECTRIC CAR

LEMO's brand-new high power M Series Connector
Small, light, robust, reliable and powerful. Engineered to revolutionise the engine performance of your electric race cars or standard cars, commercial vehicles or large-size drones.

essencedesign.com

HEADQUARTERS

SWITZERLAND
LEMO S.A
Tel: (+41 21) 695 16 00
info@lemo.com

SUBSIDIARIES

AUSTRIA
LEMO ELEKTRONIK GESMBH
Tel: (+43 1) 914 23 20 0
sales@lemo.at

BRAZIL
LEMO LATIN AMERICA LTDA
Tel: (+55 19) 3579 8780
info-la@lemo.com

CANADA
LEMO CANADA INC
Tel: (+1 905) 889 56 78
info-canada@lemo.com

CHINA / HONG KONG
LEMO ELECTRONICS
(SHANGHAI) CO.LTD
Tel: (+86 21) 5899 7721
cn.sales@lemo.com

DENMARK
LEMO DENMARK A/S
Tel: (+45) 45 20 44 00
info-dk@lemo.com

FRANCE
LEMO FRANCE SÀRL
Tel: (+33 1) 60 94 60 94
info-fr@lemo.com

GERMANY
LEMO ELEKTRONIK GMBH
Tel: (+49 89) 42 77 03
info@lemo.de

HUNGARY
REDEL ELEKTRONIKA KFT
Tel: (+36 1) 421 47 10
info-hu@lemo.com

ITALY
LEMO ITALIA SRL
Tel: (+39 02) 66 71 10 46
sales.it@lemo.com

JAPAN
LEMO JAPAN LTD
Tel: (+81 3) 54 46 55 10
lemoinfo@lemo.co.jp

NETHERLANDS / BELGIUM
LEMO CONNECTORS BENELUX
Tel: (+31) 251 25 78 20
info@lemo.nl

NORWAY / ICELAND
LEMO NORWAY A/S
Tel: (+47) 22 91 70 40
info-no@lemo.com

SINGAPORE
LEMO ASIA PTE LTD
Tel: (+65) 6476 0672
sg.sales@lemo.com

SPAIN / PORTUGAL
IBERLEMO SAU
Tel: (+34 93) 860 44 20
info-es@lemo.com

SWEDEN / FINLAND
LEMO NORDIC AB
Tel: (+46 8) 635 60 60
info-se@lemo.com

SWITZERLAND
LEMO VERKAUF AG
Tel: (+41 41) 790 49 40
ch.sales@lemo.com

UNITED ARAB EMIRATES
LEMO MIDDLE EAST
info-me@lemo.com
Tel: (+971) 4 454 9833

UNITED KINGDOM
LEMO UK LTD
Tel: (+44 1903) 23 45 43
lemouk@lemo.com

USA
LEMO USA INC
Tel: (+1 707) 578 88 11
info-us@lemo.com

NORTHWIRE INC
Tel: (+1 715) 294 21 21
cableinfo@northwire.com

DISTRIBUTORS

AUSTRALIA
JOHN BARRY GROUP PTY. LTD
Tel: (+61 2) 93 55 23 80
lemo@johnbarry.com.au

CHILE
3GT LAB ST
Tel: (+56) 2 2235 08 35
contacto@3gt.cl

CZECH REPUBLIC
MECHATRONIC SPOL. S.R.O.
Tel: (+420 2) 679 13973
mechatronic@volny.cz

GREECE
CALAVITIS S.A.
Tel: (+30 210) 7248 144
technical@calavitis.gr

INDIA
PT INSTRUMENTS PVT. Ltd
Tel: (+91 22) 2925 13 53
ptinst@vsnl.com

ISRAEL
AVDOR TECHNOLOGY LTD
Tel: (+972 3) 952 02 22
sales@avdor.com

NEW ZEALAND
CONNECTOR SYSTEMS
HOLDINGS LTD
Tel: (+64 9) 580 28 00
sales@connectorsystems.co.nz

POLAND
SEMICON
Tel: (+48) 22 615 64 31
info@semicon.com.pl

RUSSIA
SCS
Tel: (+7 495) 223-4638
(+7 495) 997-6067
info@lemo.ru

SOUTH AFRICA
JAYCOR INTERNATIONAL
(PTY) Ltd
Tel: (+27) 11 444 1039
jeff@jaycor.co.za

SOUTH KOREA
SUNG SHIN I&C CO., LTD
Tel: (+82 2) 2026 8350
mail@sung-shin.com

TAIWAN
EVERHARMONY ENTERPRISE INC
Tel: (+886 2) 27 07 00 69
ever.harmony@msa.hinet.net

TURKEY
MAK SAVUNMA LTD STI
Tel: (+90 312) 256 16 06
sales@maksavunma.com

UKRAINE
U.B.I.
Tel: (+380 44) 568-5765
info@lemo.ua

CONNECTED ONLINE

LEMO®

www.lemo.com

info@lemo.com