Preventing brain damage with innovative sensors

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Swiss SME NeMoDevices and its partners have developed and patented two groundbreaking sensors to help doctors save the lives of patients threatened by strokes and other brain injuries. With commercialisation negotiations now underway, NeMoDevices and project partner Creaholic are exploring new applications for their technology.

Around 7 million people suffer brain damage due to stroke, heart attack and head trauma every year across the EU alone. The economic cost is among the highest of any medical condition, to say nothing of the impact on patients and their families.

One key to reducing this suffering is to give doctors a better picture of how much oxygen is getting to the brain. The problem, explains NeMoDevices' founder Professor Emanuela Keller, is that "only imaging

devices can measure cerebral blood flow accurately, but they're too bulky for the bedside or surgical theatres. We do have ultrasound at the bedside, but it doesn't measure the volume of blood flowing, nor its oxygen concentration. Both factors are critical to preventing brain damage."

In 2000, Professor Keller realised that optoelectronics could do better. As head of the Neurointensive Care Unit at University Hospital Zurich, she turned to the University's engineers for help. Seven years of research and two patents followed.

University spin-off

"Those first patents were very ideas-based, so we still had work to do," Professor Keller recalls. "NeMoDevices was founded as a spin off with exclusive licenses for the patents by the University and ETH Zurich in 2007."

Four years later, NemoDevices launched Opto-Brain with Swiss innovation house Creaholic, German usability experts Use-lab, and medical universities from Austria and Germany for clinical testing.

Together, the three SMEs developed two new products: NeMo Probe, which is inserted into the brain to measure bloodflow directly, and NeMo Patch, which measures via a patch applied to the scalp. Both monitor the quantity and oxygen concentration of blood flowing in the brain using miniaturised optoelectronics, measuring the way four laser beams reflect off blood vessels in the brain. Two more patents resulted from the project.

The two devices are complementary, explains Professor Keller. "While we need to drill a hole in the skull to use the Probe, doctors do that anyway to measure the pressure in the skulls of patients at risk. We

shrank our Probe to the same size as today's pressure probes, so it measures much more without requiring more surgery."

The Patch, on the other hand, can monitor patients' cerebral blood flow from the bedside, non-invasively. This opens brain monitoring to entirely new groups of patients, potentially preventing brain damage in millions of people.

Multiple applications to come

"We didn't have all the skills we needed inhouse, so the Opto-Brain project was crucial in turning our research into marketable products," Professor Keller explains. "Use-Lab developed an interface suited to the clinical environment, which is absolutely critical if doctors are to accept any new technology. Creaholic´s skills with materials, on the other hand, were essential for the Patch – in fact, they co-own that patent."

All three SMEs are growing as a result: NeMoDevices, awarded the CE mark in July 2015, are currently planning the market entry for their products and developing new medical applications in parallel; Use-Lab has launched a new medical design unit; and Creaholic is developing applications for the Patch outside the human body, for which they have exclusive licenses.

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