



PRESS INFORMATION

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Visualise the future with image-guided therapeutic methods

Pioneering international research campus STIMULATE in Saxony-Anhalt, Germany, develops minimally invasive diagnostic and therapeutic methods



Bundesministerium
für Wirtschaft
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It is still utopia: a paraplegic patient can once again move his limbs in an entirely normal manner solely with this power of his thoughts. Yet little by little this utopia is becoming reality, and specialists in Magdeburg, the capital of the German Federal State of Saxony-Anhalt, are also working at it.

The key is the measurement of brain activity. Science has made rapid advances in recent years. Based on the electrical activity measured directly in the brain, computers can already easily detect whether and which movements the patient would like to perform.

“Electrodes must be implanted in the brain for its measurement, and while doing so there is an ethical problem”, say neuroscientist Prof Hermann Hinrichs with regard to restrictions. “Such interventions are not without risk.” Whereas the signals are measured with electrodes which – like an electroencephalogram (EEG) – are applied to the head externally without risk, the results are not so good. So science has to decide: risk-free, but metrologically inaccurate signals, or more suitable, but ethically more critical signals. Or otherwise a balance has to be struck. The balance which is being worked on in Magdeburg is called magnetoencephalography (MEG). This procedure measures brain activities – with sensors outside the skull. The brain’s magnetic fields are recorded and measured with inductors. “In doing so, the bones in the skull are less impaired than with an EEG”, explains Hermann Hinrichs. “The signals are not as exact as with the implanted electrodes, but they are significantly better than with an EEG.”

The research campus STIMULATE offers scientists optimal possibilities for tests. STIMULATE stands for “Solution Centre for Image Guided Local Therapies”. The technology utilised by the research campus in the Experimental Factory on the outskirts of the Otto-von-Guericke University Magdeburg campus makes the hearts of researchers beat faster: a modern operating theatre with a mobile X-ray unit and an MRI scanner immediately strikes the eye. High-resolution monitors show ultra-large images of what is happening on the operating table. On other monitors one sees the images which the MRI scanner generates.

STIMULATE is one of the showcase projects in Saxony-Anhalt. The federal government and state provide funds, and STIMULATE is among the nine sponsored research campuses nationwide. Magdeburg is successfully prevailing in the competition with other renowned research institutions. One of the great advantages of the Magdeburg location: physicians and engineers have already been working closely together here for years.

The focus of Magdeburg researchers is on image-guided minimally invasive diagnostic and therapeutic methods. For instance, miniature catheters whose

movements can be tracked precisely in blood vessels or in the brain with the help of imaging procedures such as MRI scanners are being developed here. Scientists in Magdeburg with their partners are focussing on several neurological diseases such as stroke and cancer diseases such as hepatic and spinal tumours. The goal is to treat patients less invasively and better.

“We have four priorities”, enumerates Prof Georg Rose, Director of the Institute of Medical Technology at Otto-von-Guericke University Magdeburg. “Brain-machine interfaces (BMI), i.e. the interaction of brain and machine, robotics in surgery, efficient stroke care in the hospital and the treatment of hepatic tumours in MRI.”

Engineers and physicians are working meticulously on robots which shall assist during operations, for example during operations where very great precision is called for, such as spinal operations. “Robots can operate much finer and much more accurately than a human. Their probability of error is less than that of the human surgeon”, explains Georg Rose. “But imagine something happens. That would not be ethically justifiable.” So the robot “colleague” works under human supervision, and for example, merely holds a tube which precisely indicates the direction through which the physician inserts his needle/electrode.

Methods for optimisation with regard to the care of stroke patients are being sought in Magdeburg. “The ‘time is brain’ principle applies”, explains brain researcher Hermann Hinrichs. “The quicker a patient is helped, the more brain cells we can save and the less severe the complications are.” In order to save transport routes and thereby also time, research is also being conducted in Magdeburg with regard to an optimal treatment room for stroke patients. “The patient shall be spared the sheer back and forth movement from room to room”, explains Georg Rose. “We envision a central treatment room in which the patient can be examined and also immediately operated on – we call it ‘one-stop-shop’.”

And finally, the scientists from Magdeburg are working on improving electrodes for invasive measurements in the brain. They are internationally at the forefront in this regard. Hermann Hinrichs puts it in a nutshell: “We bring together freedom from risks and good signals.” It has been reported in the USA that there are a few patients who can control the individual limbs with their motion request that is recorded by means of implanted electrodes. For instance, a patient with the muscular disorder ALS (amyotrophic lateral sclerosis) was able to guide a cup to his mouth through his thoughts with the control of a special robot similar to a human arm.

However, the safety requirements for such technologies are very high, particularly also in Germany, and the certification procedures are very expensive. The technology itself is far advanced. The first robots have already been equipped with autonomous intelligence, and already recognise up to about 90 percent of the motion requests sent from the brain. As a result, it could soon be possible to initiate complex everyday movements through brain activity, but then it would be largely autonomous from a robot. This can also give hope for patients undergoing rehabilitation. They could achieve successes much quicker, says Georg Rose in mentioning a conceivable applicability.

But companies are keeping a low profile. “These technologies are very expensive, bear a high risk and do not have a large market”, says Georg Rose in explaining the reasons.

“It must be clarified what happens in the event of a power loss and who assumes responsibility; for example, if the robot makes a mistake when driving a car, if a patient sustains an eye injury due to a mistake, and if he or she actually wants to guide their hand towards their mouth.”

It is not very easy to find suitable companies for the commercial implementation of these developments. Scientists from Saxony-Anhalt are also travelling to Asia in February in order to look for possible partners for production and marketing of their research results there in Malaysia and Singapore.

This can be partners from industry, companies which produce what the scientists in Magdeburg invent. Or it can be those who work together with medical technology companies in Saxony-Anhalt, since within the state and also globally there are already several collaborations working quite well.

Magdeburg has set high goals. STIMULATE shall become the German centre for image-guided medicine. Researchers have already been able to record several publications and partial successes along the way.

For instance, a test person has already managed to control a robot – that was in a building on the other end of the city – with his thoughts! The two communicated with each other via the Internet. The test person moved a robotic arm with his power of thought!

More information about the Investment conference "**CHECK-IN FOR SUCCESS Saxony-Anhalt**":

<http://www.invest-in-saxony-anhalt.com/CHECK-IN-FOR-SUCCESS-2016>.

More information about the medical engineering location **Saxony-Anhalt**:

<http://www.invest-in-saxony-anhalt.com/medical-technology>

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Photo:

The research campus STIMULATE offers scientists optimal possibilities for tests. STIMULATE stands for "Solution Centre for Image Guided Local Therapies".
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