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TREND REPORT

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# Five medtech trends you shouldn't miss

**Algorithms are behind most of the trends in medical technology. Software, in other words. Even if biocompatibility of materials is still undergoing very rapid development, the major game changers in medical technology are nothing without software, which is an increasingly important element in any medical device. Big Data and artificial intelligence are producing new levels of quality in diagnostics. Networking of patients and physicians enables round-the-clock care during treatment, and takes state-of-the-art diagnostics into the patient's own living room. Intelligent implants provide an almost autonomous control loop between diagnostics and treatment. The development of nanorobots, which relies on nano-3D printing, would also be impossible without the use of algorithms. All of this is highlighted at MedtecLIVE, the meeting place for the medical technology sector, at the Exhibition Centre Nuremberg from 21 to 23 May.**

## Trend 1: Software for more accurate diagnostics and treatment

The latest medical devices, like surgical robots, and x-ray and lab devices for in vitro diagnostics, consist largely of software. Growing complexity and shorter and shorter release cycles also mean software must be created using a suitable agile development process, from the enquiry through to the release stage. Short feedback cycles create the opportunity to implement necessary changes in compliance with procedure, quickly and in high quality. The ideal software suppliers are those that have specialised in medical technology developments and, as external partners, add intelligence – i.e. the necessary software – to OEM products.

"Basically, medical products are growing more complex," observes Alexander Brendel, Director Life Science at Infoteam Software AG, a supplier of standards-compliant software solutions. "And expectations in

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terms of ease of operation and reliability are on the rise at the same time. They therefore have to cover more scenarios in accordance with the relevant standards. This applies to software development in particular." He also observes, "More and more functions are being performed by software, devices are networked over the Internet, or use wireless communications channels. That's why ISO 13485, IEC 62304 and also the MDR and IVDR and the FDA are addressing the question of software in medical products to a much greater extent than previously." There are a few rules to observe with medical software, in other words.

Patient safety is always at the centre of the development process. But usability also plays an increasingly weighty role: "More and more, we find that the graphic user interface is of particular importance," comments Moritz Hoyer, Site Manager of consultancy firm Medidee Services (Deutschland) GmbH. According to a study by the FDA, about 80 percent of the errors that happen in hospitals can be traced to shortcomings in applicability. "That is one of the reasons why there is a growing focus on suitability for use," Hoyer notes. "And that's important, to ensure that users, doctors, nursing staff, therapists and the patients themselves really can handle the devices safely."

**Trend 2: Artificial intelligence – the doc via the net**

From applications in medical imaging and medication development through to the "robo-doc" in a mobile phone application, a lot is entrusted to artificial intelligence (AI) these days. Many start-ups, success stories and widespread reporting in the media have made machine learning and pattern recognition extremely topical. In the vision of a Smart Hospital of the future, the use of AI could not only make work much easier when it comes to registration formalities, but for diagnosis and in the OR, AI also has the potential to take the load off doctors, help them to achieve greater accuracy, and also save them valuable time. And that is exactly what Siemens Healthineers, a global leader in medical technology, is working on. The shortage of skilled employees is just one reason support from AI is urgently needed: for example, the number of CT scans performed every year is rising by ten to twelve percent, while the number of radiologists, by comparison, is increasing by only three to four percent. This is why radiologists normally have only a few minutes to look closely at an image.

Studies reveal that the rate of diagnostic errors increases with the speed of diagnosis, observes Jörg Aumüller, Head of Digitalizing Healthcare Marketing at Siemens Healthineers. “The AI-Rad Companion Chest CT, an AI-based application for computed tomography, is intended to help radiologists to interpret chest images faster and more accurately,” says Aumüller, describing one of the approximately 40 applications from Siemens Healthineers that use AI.

In most cases, machine learning is thought to be the same thing as artificial intelligence, although it is only one of a whole series of procedures. The volume and quality of training data is crucial to the success of learning systems, and data of this nature is not easily available in the medical sector. Data acquisition and collection using sensor technology and software, and the accompanying process of quality assurance by humans, therefore play a special role in this area.

Will Big Data make clinical studies superfluous in the future? In a Euroforum study, 32 percent of those surveyed thought so. At the same time, 44 percent expect the digital transformation to mean that patients will no longer go to the doctor when they have something wrong with them, but expect instead that the doctor will actively make contact as soon as there is any sign of a disorder. Data will provide the basis – data collected from every individual person, aggregated in huge volumes, and then analysed using pattern recognition procedures. Big Data has the potential to put medical and pharmaceutical technology on a new empirical basis. Will Big Data even supplant evidence-based medicine? That question cannot be answered – yet.

**Trend 3: Mobile Health – best care at home and on the go**

If physicians actively seek out their patients when the data points to a disorder, there will be no more need for the traditional general practice. Denmark has turned its attention to home care and telemedicine, and centralised electronic patient records. Based on Denmark’s own analysis, this ensures very good care for the country’s population of around five million. And its health costs per capita are lower than in Germany.

“A solution, however, is only ever as good as the data that’s used to feed it,” comments Christian Graversen, Director of the Danish e-health cluster Welfare Tech. “People must be prepared to share their data. And the

information must be regularly updated." For an e-health system to work, the data has to buzz – like in Denmark.

Because of the fundamental differences in understanding of how to handle patient data, many aspects of Denmark's e-health initiatives cannot be transferred to Germany. But in Germany, too, collaborative research arrangements and start-ups are working on technologies, strategies and business models to take e-health applications onto the market. One of these is Portabiles Healthcare GmbH, which uses a sensor fitted in a shoe to measure the patient's gait. To provide treatment for Parkinson's Disease, the treating neurologist thus receives comprehensive data on changes in gait – and thus important insights into the progress of the patient's disease. The fact that the patients can wear these shoes all day as they go about their normal activities gives attending doctors the opportunity to stay completely up to date with their patients' mobility. "That means they can adapt their treatments to the patients' individual needs in good time," comments CEO Ralph Steidl. This is an e-health solution that promises much more accurate treatment options than a 15-minute visit to the doctor once a quarter, which is still the usual practice. "By using artificial intelligence we want to draw on the patient's gait pattern to predict the course of the disease to a certain extent, and calculate, for example, the patient's individual risk of falling," says Steidl, highlighting some of the opportunities.

**Trend 4: Intelligent implants – no cyborgs here**

"Intelligent implants are becoming more and more important in the medical sector, but at the same time they are among the most technically challenging and risky medical products." That was a quote from a survey of experts by the German Society for Biomedical Engineering (DGBMT im VDE) in 2013. That same year, security expert and prominent hacker Barnaby Jack died shortly before he was due to speak on the subject of "Implantable medical devices: Hacking humans" at an IT conference. Two years later, Marie Moe, from Norway, picked up the theme at the congress of the Chaos Computer Club with a presentation entitled "Unpatchable. Living with a vulnerable implanted device". Despite their vulnerability, intelligent implants offer patients many benefits, and are a veritable medical

jewel in the crown: sensor and actuator technology, for example, work fully autonomously to ensure the right dose of medications.
The technical terminology refers to both closed-loop implants and active implantable medical devices – although the latter do include other products. But even if the expressions differ, they reference the same concept: implants that combine actuator and sensor technology and signal processing. And although the expression might suggest otherwise, they are not a particularly new field of medical technology. The traditional pacemaker could be considered the ancestor of all intelligent implants.

New manufacturing processes, state-of-the-art composite materials, and digitalisation in particular have increasingly been driving this field in recent years. A whole series of intelligent implants are now in use – or are not far off. Many experts also count cochlear implants alongside the pacemaker. There is practically no part of the body that could not make use of closed-loop systems in the near future: bladder, epilepsy or deep brain stimulation; retinal implants; dosing systems; an artificial pancreas or sphincter – the more scientists and doctors you ask, the longer the list.

**Trend 5: Nano-3D printing – for the nanorobot in the bloodstream**
Nanomanufacturing is a future-oriented technology. And nano-3D printing is becoming increasingly popular, in medicine and elsewhere: whether for personalised implants, perfectly fitting organ transplants, or for bioprinting. Additive manufacturing already offers a range of fascinating opportunities that would have been inconceivable even just a few years ago. “Nanotechnology is an enabling technology,” explains Professor Harald Fuchs, Director of the Physical Institute of the University of Münster. “That means it improves existing procedures and can achieve results that would not be possible using traditional methods.” It can be used in a wide range of fields: for diagnostics, in the OR or for treatment – research is in progress in many areas. Thus, for example, work is being done on developing ultra-small lenses for micro-optical elements in endoscopes.

Nanorobots that can be controlled remotely are an exciting forward-looking development that scientists from the Max Planck Institute in Stuttgart are currently working on. Together with an international team of researchers,

they have developed propeller-shaped nanorobots that can even penetrate dense tissue in the eye. The propellers are only 500 nm wide and have a non-stick coating, which lets the robots move without damaging sensitive tissue. This scenario has been successfully tested on a dissected pig's eye. The researchers' goal is to refine the robots to the point where, at some point in the future, they can carry medication to provide minimally invasive treatment for all kinds of diseases.

Sensors, tumour-destroying nanorobots and minuscule electronic eagle-eyes swimming through our bloodstream – nanotechnology is progressing at a huge pace, and is highly promising. Quite a lot of this can be achieved using nano-3D printing. In the area of sensor technology, this offers opportunities that would have been unimaginable just a few years ago. The special thing about nanosensors is that they are so much smaller than the sensors currently in use. "A nano expansion sensor is just 0.3 microns (300 nanometres) long and wide," explains Dr Konstantin Kloppstech, Head of Technology at NanoScale Systems GmbH, which specialises in nano-3D sensor printing. "That means the diameter of a human hair is about 250 times the length of a nanosensor. Putting it another way, you could print about 900 nanosensors in the space occupied by a single hair." This is a major advantage for sensor systems that are directly implanted in the human body in particular, given that the body usually perceives them automatically as foreign bodies. "The immune system defends itself as a consequence," notes Kloppstech. But the smaller the sensor system, the less the body will react. It can also be implanted using a minimally invasive procedure.

MedtecLIVE 2019 is the ideal platform for discussion between experts on these and other trends. Specialists can discuss them in detail, share experiences and present innovations. And it provides the perfect venue for trade visitors to pick up valuable knowledge about the future of medical technology.

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