University of Basel

Press release

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CHF 12 million funding for cutting-edge surgical technology

Researchers at the University of Basel have a vision: an individually configurable robot that will revolutionize surgical procedures and provide numerous benefits for patients. They have already taken the first steps in this direction. To further implement their vision, the Werner Siemens Foundation is now extending its funding for the "Miracle" project by CHF 12 million to a total of CHF 27 million.

Planning an operation in virtual reality, cutting a bone with high precision using an intelligent laser saw and using 3D-printed organic implants such as a new knee joint in a minimally invasive surgical procedure: researchers of the "Miracle" (Minimally Invasive Robot-Assisted Computer-guided LaserosteotomE) project want to transform surgery by adapting it to meet the needs of individual patients even more precisely.

During the first project phase, the participating research groups developed technologies to be used in future operating rooms. The second phase now involves combining the individual systems (see "additional context" below) into a modular robot, which can be individually configured for the planned surgical procedure and which already includes the operating table and lamps. The surgeons can monitor this system during the procedure via a console.

For the second project phase, the Werner Siemens Foundation is topping up their funding for the project, which has been running since 2015, by an additional CHF 12 million. "We are deeply grateful to the Werner Siemens Foundation for supporting our visionary project," says Professor Philippe Cattin, co-director of both Miracle project phases and head of the Department of Biomedical Engineering at the University of Basel. This opens up a unique opportunity for Basel, a city known for innovation. "Thanks to this financing and our expertise, we are now able to tap into huge opportunities that will open the door for robotics in surgery."

Custom 3D-printed organic implants

In the first project phase, the team headed by Cattin developed a virtual reality platform for planning surgeries, which is already being used in the hospital. Now this system will also be used to design the shape and composition of implants. In contrast to older, primarily manual methods, this approach aims to enable faster and more precise design. The implants designed in this manner will then be custom manufactured using 3D printing. In the future, it may even be possible to print the implants directly within the body.

“With Miracle, we don’t just want to develop a new technology but rather fully transform bone surgery,” explains Professor Hans-Florian Zeilhofer, surgeon and delegate for innovation at the University of Basel, who headed the first project phase together with Cattin.

“A lot of the surgical procedures we can plan on the computer are not yet possible using currently available tools,” says PD Dr. Dr. Florian M. Thieringer, oral and maxillofacial surgeon, who is co-directing “Miracle II” with Cattin and also heads the 3D print lab at the University Hospital of Basel. “We are currently developing the technology with which we can implement this in the operating room.” The idea that surgeons like himself will one day be fully replaced by the robots he is helping to create does not worry him, however: the exact planning and strategic decisions on procedures will remain the domain of medical specialists.

Further information

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Additional context

Three research goals:

A flexible, modular robot system

The robot-supported endoscope (tool for examining the body and extracting tissue samples) developed in the first project phase will be supplemented with additional specialized endoscopes and coordinated with all the other devices in an operating room. In order to achieve optimal performance, the robot arms, the operation lamps and the operating table will be combined into one large robot system.

Designing implants via virtual reality

The system developed to plan surgical procedures in virtual reality (VR) will be expanded so that the exact shapes of bone replacement implants can be determined directly in the VR. Furthermore, this platform will be expanded through haptic feedback (technical simulation of touch) and thus enable the performance of patient-specific simulations of surgical procedures. With this type of system, the surgeon would be able to practice a procedure before carrying it out.

Intelligent organic implants

Three-dimensional imaging technology aims to identify defective tissue, measure it in 3D, and determine the structure of corresponding patient-specific implants. The patient-specific high-performance implants will then be grown in bioreactors or created using robot-supported organic printing technology outside and inside the body through a 3D printing process.

Project websites: Miracle I and Miracle II

Pictures: Please refer to the accompanying PDF for an overview. The images can be downloaded in high resolution from the media database.

Video (Youtube): short version (2:29), long version (10:49)