Press release – Embargoed until 8am on 12 December

A 12 million franc donation to create a Center for Artificial Muscles

Thanks to a donation from the Werner Siemens-Foundation, EPFL will set up a Center for Artificial Muscles, collaborating initially with the University Hospital of Bern (Inselspital) and then with the University Hospital of Zurich. The first project, slated to span the next four years, will focus on developing a less invasive cardiac assistance system for treating heart failure. This prosthetic device – a ring around the aorta – will avoid the complications of hemorrhaging and thrombosis because it will not be in contact with blood. A facial-reconstruction project aimed at restoring patients' ability to create facial expressions will follow.

Many forms of heart disease end in cardiac failure. Patients can be saved only by a heart transplant or a complicated assistance system. To help diseased hearts pump blood, researchers at the Integrated Actuators Laboratory (LAI) on EPFL's Microcity campus in Neuchâtel have been working for some time now on a new, less invasive cardiac assistance system. It consists of a ring placed around the aorta and controlled by magnetic induction. This project has attracted the attention of the Werner Siemens-Foundation, which has just donated 12 million francs to EPFL to set up a Center for Artificial Muscles (CAM). "With this donation, we really hope to help drive the study of muscle conditions through the advanced research that will be carried out by the Center. This revolutionary and forward-looking project aligns perfectly with the Foundation's sponsorship criteria," said Hubert Keiber, the Foundation's chairman.

A less invasive approach

The Integrated Actuators Laboratory, which is run by Yves Perriard, will develop the assistance system together with Thierry Carrel, the chairman and head surgeon of the Department of Cardiovascular Surgery at Bern's Inselspital. "Our system will obviate the need to operate on the heart. The ring placed around the aorta and controlled by magnetic induction will help the heart pump blood. This method will therefore be less invasive than current procedures used in cardiac assistance," says Dr. Perriard.

The device will be composed of a series of rings made out of dielectric electroactive polymers (DEAPs). These polymers dilate when a current is applied and contract when the current is switched off. Because the reactions are immediate, the contraction-relaxation movement can be controlled in real time. "This material is unusual in that it is incompressible, which means its volume remains constant. As a result, its surface area expands elastically as it stores the energy it receives," says Jonathan Chavanne, a PhD student at the LAI who is in charge of prototype development. When placed around the aorta, these rings will therefore help the heart pump blood.

Treating patients earlier
The funds provided by the Werner Siemens-Foundation will be used to create a project team at the Center to further this research. Six full-time staff – two PhD students, two post-docs and two engineers – will be devoted to developing the technique. They will benefit from the expertise of Dr. Carrel, a renowned cardiac surgeon.

Its research group at the ARTORG Center for Biomedical Engineering Research and the experimental surgery section of the Department for BioMedical Research at the University of Bern will make a significant contribution to the project. For the past few years, ARTORG's cardiovascular engineering group has been working on simulation experiments in the area of mechanical circulatory assistance. This less invasive method adds an important dimension to current heart failure treatment.

Carrel will oversee the entire first phase, which will be spread out over four years. At the end of this phase, and after the technology has been thoroughly vetted in laboratory tests, the surgeon will implant the device on animals. It is only then that the researchers will know if the technology is viable. Dr. Carrel sees a number of advantages in this device: "For patients, this technology would definitely be less invasive than current cardiac assistance systems because it does not interfere directly with the blood flow or blood cells. It may also turn out to be effective in treating terminal heart failure earlier than current methods." EPFL President Martin Vetterli adds: "This project, at the crossroads of engineering and medicine, offers real potential. I am especially pleased with the university collaborations it has led to, including the one with Inselspital."

First the heart, then facial expression
The ambitious plans for the Center do not stop with cardiac assistance. The Center will branch out into other fields in two subsequent phases, which will take place over eight years starting in 2022. One project will focus on the urinary sphincter, while the other will delve into the reconstruction of facial muscles so that victims of serious burns and other accidents can regain control of their expressions. This latter project will involve Nicole Lindenblatt from the Clinic for Plastic and Reconstructive Surgery at the University Hospital of Zurich.

The Werner Siemens-Foundation
The Werner Siemens-Foundation supports innovative technological and scientific research projects in universities and other institutes of higher education that meet strict standards. It also supports select projects aimed at educating, training and promoting young researchers.

Links
Integrated Actuators Laboratory (LAI)
Department of Cardiovascular Surgery at Inselspital

Funding
Werner Siemens-Foundation: www.wernersiemens-stiftung.ch/en/home

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