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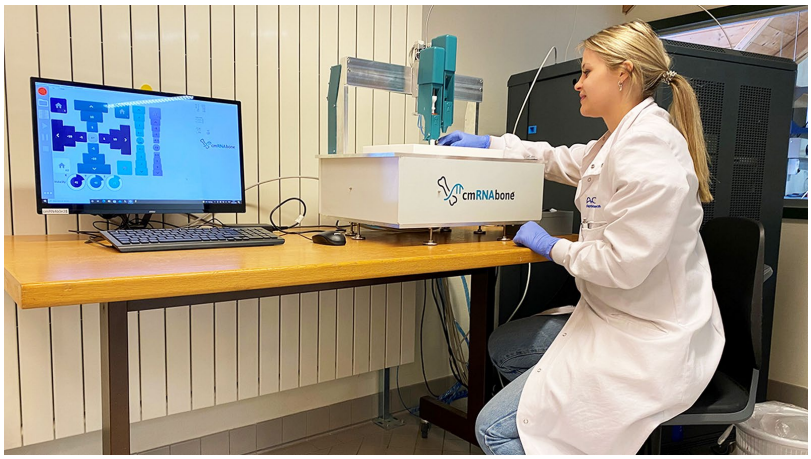
Research in the Grisons

Bone replacement from the 3D printer

The AO Research Institute Davos leads EU project

The conference “Graubünden forscht” (www.gr-forscht.ch; Davos; September 21 and 22, 2022) will bring together young scientists from a wide range of research fields that are of social and economic importance for Graubünden and the Alpine region. Until September, we will give you a monthly preview of an exciting project.

The AO Research Institute in Davos has been developing new methods for treating bone fractures for decades. When you break a bone, sometimes there is a large gap in the injured bone. The clinical gold standard to repair the defect is autologous bone grafting. This means that a surgeon takes bone from another part of the patient’s body to fill the gap. If the gap is very large, a lot of bone is needed, and harvesting the bone causes another painful injury.



3D Printing on custom-made printer provided by cmRNAbone project partner Idonial. Photo credit: AO Research Institute Davos

Daphne van der Heide, a native of the Netherlands, has been conducting research at the AO Research Institute since September 2020 for a major EU project aimed at developing a new bone substitute material. This laboratory-generated bone substitute material could one day provide an alternative to the bone harvesting described at the beginning of this article. Van der Heide gives the key data and describes the novel approach of the cmRNAbone project: “The European research program Horizon 2020 is funding the project with 6.3 million euros. Professor Martin Stoddart, my boss, is responsible for the overall coordination of the eleven project partners from six European countries. Each of the participating university research institutes and companies brings specific expertise to the table, and there is close collaboration among them. The project combines genetic research, nano- and biotechnology and 3D printing. The novel approach is to develop chemically modified RNA (cmRNA) in the laboratory, which contains the blueprint for specific proteins that will eventually develop into bone, blood vessels or tissue. The universities of Basel and Maastricht are conducting research on cmRNA. The cmRNA will then be embedded in a biomaterial ink made of hyaluronic acid and calcium phosphate particles.”

Together with Matteo D'Este, creating the biomaterial ink is van der Heide’s job: “We have to find the optimal concentration of materials (hyaluronic acid and calcium phosphate particles) that is both printable and exhibits the desired biological properties. Therefore, we first try manually with syringes of different sizes to see if the ink can be squeezed through the needle. If

it's not possible to squeeze the ink by hand, it won't work with the 3D printer either. The Spanish company Idonial is developing a special 3D printer that will be able to print an implant from the biomaterial ink that fits the patient's specific bone defects. The project is in the development and testing phase. The implants, formed using the cmRNAbone method, will be tested for the first time this summer in experimental rats at the Universities of Basel, Bordeaux and Maastricht."

Daphne van der Heide. Photo credit: AO Research Institute Davos

Daphne van der Heide and Daniela Heinen

The AO Research Institute Davos (ARI) has a leading role worldwide in the field of preclinical research for trauma surgery and orthopedics. The research work carried out at its headquarters in Davos makes a significant contribution to Davos' recognition as a research location. www.aofoundation.org/ari