HYLOMORPH

Improving the biocompatibility of medical implants
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It is estimated that more than 10 million medical implants are implanted in patients each year worldwide, notably for cardiovascular and plastic surgery.

Due to sub-optimal biocompatibility of existing medical implants, every time one is placed in a patient by a surgeon, fibrosis occurs in the surrounding tissue: the patient’s immune system responds with the so-called foreign body reaction, in which the hosting tissue recognizes the implant as foreign and covers it with a thick layer of fibrotic tissue, in the attempt of isolating, destroying and expelling it.

Fibrosis is among the primary causes for malfunction and failure of implantable medical devices. In addition, fibrosis is associated with infections and can cause pain to the patients. Consequently, revision surgeries are often required post-implant, leading to a costly and lengthy recovery process. It has been reported that up to 20% of all implanted patients need correcting intervention and implant replacement due to fibrosis.

To address this critical medical need, the HYLOMORPH team has developed a unique surgical membrane that optimizes the interface between implants and human tissue. Preparation of the membrane consists of a patented biotech process, in which a non-pathogenic bacteria is cultured in combination with micro-engineered silicone surfaces to produce thin films of biosynthesized cellulose, featuring a finely controlled surface topography. In pre-clinical studies conducted by the team, micro-structured biosynthesized cellulose membranes led to an 80% reduction in fibrotic tissue formation at three months after surgery.

Based on these promising results, the team is now working in close collaboration with the German Heart Institute Berlin (Deutsches Herzzentrum Berlin, DHZB) and the University Hospital Zurich to prepare for the first-in-man application of cellulose membranes on implantable loop recorders (electrocardiographic monitoring devices). If the results are confirmed in humans, micro-structured biosynthesized cellulose membranes could be the first anti-fibrotic solution for medical implants for the prevention of associated surgical complications.

The HYLOMORPH project was started at Wyss Zurich as a collaboration (“HeartOne”) with the Zurich Heart, a research initiative of Hochschulmedizin Zürich that aims at revolutionizing ventricular assist device technologies based on a variety of novel approaches.