

*1. Stem cell engineering for the support of pyrolytic carbon joint implants.*

The objective of the proposed project is to develop a new joint capsule by transplanting fat tissue derived “stem cells” onto pyrolytic carbon joints to replace diseased joints.

The outcome of this proposed project would considerably broaden the indications for use of joint capsule implants also in those patients who currently do not qualify for such implants. Traumatic joint diseases would be treatable with this novel biological autologous capsule, which can resemble many properties of natural tendon and cartilage. The patients treated with joint capsule implants and engineered joint capsules are expected to benefit with a marked improvement in the range of motion of the affected joint together with improved joint stability, resulting in an overall increased quality of life.

*2. Repair of aortic aneurysm using stem cell coated stents.*

The goal of this research is to develop a scaffold as a supporting structure for the grow of mesenchymal stem cells (MSCs). This scaffold will be used in patient with aortic aneurysm to prevent ruptur of the aortic aneurysm. Developing the supportive structur is the key initial step in the project. The second focus is the grow of fat tissue derived stem cells on such a structure. Additionally the means of implanting the scaffold have to be developed since the stem cell coated scaffold will be implanted using an interventionell approach.

*3. Catheter-based application of stem cells for myocardial repair.*

This is an initial research grant application for the development of the novel principle of balloon catheter protected transcronary and transcronary sinus application of myogenic and angiogenic cells for repair of the myocardium following a myocardial infarction and its intended clinical evaluation. The occluded target coronary artery will be reopened by PTCA and/or stenting. According to the results of projects A-C autologous adult stem cells from bone marrow / subcutaneous fat tissue will be transplanted by injection into the coronary artery restoring cardiac function.

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*Detection of unstable coronary plaque by the use of antigen directed, echogenic microbubbles.*

Coronary artery disease [CAD] is one of the most important causes for mortality and morbidity in humans in the present day. Inflammation plays a major role in the progression of CAD and atherosclerosis. Inflammatory cells such as neutrophils and monocytes are activated during this process, and at the same time there is an increase in expression of different surface antigens, such as CD 11b and CD 18.

Experimental models by creating inflammation on the femoral arterial surface of rabbits have been used in the past to study inflammatory response to vessel injury, which mimic plaque rupture in humans who presented with unstable angina or heart attack. Recruitment of inflammatory cells was demonstrated by such experiments.

Microbubbles have been used clinically during ultrasound examination of the heart. They enhance the visualization of heart borders and they are also able to detect perfusion defects in patients with CAD. By labelling these bubbles with antibodies to antigens CD 11b or CD 18, which is available commercially, it is possible to detect the site and extent of inflammation.

Using a rabbit animal model, we would be able to test our hypothesis in using microbubbles to detect inflammation, and therefore unstable plaques in blood vessel. The femoral artery is more easily assessable than the coronary artery and will be used to establish the feasibility of this technique. If successful, it may also prove to be a simple, safe and non-invasive way of detecting inflammation in patients with CAD.