Cell-attracting Hydrogels for Cartilage Repair

Osteoarthritis is the most common chronic condition of the joints. It is characterized by the degeneration of articular cartilage, formation of osteophytes and alterations in the synovium. This process has a severe impact on the quality of life of the patients and the currently available treatments are unsatisfactory and often merely focused on pain relief. The project described below is aimed at the repair and restoration of a cartilage defect by applying an injectable hydrogel.

Within the DBE group, attention has been focused on the exploitation of enzymatic crosslinkable hydrogels using chemically modified polysaccharides. The use of these 3D scaffolds from natural (and synthetic) polymers have been explored for tissue engineering of cartilage. These scaffold are often cell-laden to regenerate the cartilage while the 3D scaffold is, optimally, slowly degraded. However, incorporation of (autologous) cells could delay the treatment – cells would have to be harvested, cultured and incorporated – as well as the progress towards application due to strict regulations.

In this project we look at the development of cell-free injectable hydrogels and their capability of incorporating cells from adjacent cartilage tissue. As starting point we would look at a enzymatically cross-linked hydrogel composed of hyaluronic acid and dextran, the golden standard of our group in terms of cartilage repair. These hydrogels are likely to be improved by the addition of extracellular matrix proteins. During the course of the project, we will work towards the optimum extracellular matrix content of the hydrogel, testing from protein free hydrogels towards a pure ECM hydrogel.

Project goal

Develop a cell-attracting hydrogel for cartilage repair.

During this project you carry out:

Synthesis of functionalized polysaccharides
Decellularization/functionalization of ECM
Preparation of hydrogels
Cell culture and culture of cell laden constructs
Analysis of the biological effects and cell migration in the hydrogels