Universität Basel

# Research Project

# Engineering of osteochondral composites using human articular chondrocytes and biomimetic materials

## Third-party funded project

**Project title** Engineering of osteochondral composites using human articular chondrocytes and biomimetic materials
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**Organisation / Research unit**
Bereich Operative Fächer (Klinik) / Tissue Engineering (Martin)
**Department**
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Trauma and disease of joints frequently involve structural damage to the articular cartilage surface and the underlying subchondral bone. These pathologies result in severe pain and disability for millions of people world-wide and represent a major challenge for the orthopaedic community. Albeit a series of therapeutic approaches has been developed to treat osteochondral defects, none of them has proved yet to ensure long-lasting regeneration. The ex vivo engineering of functional osteochondral composites, starting from autologous cells and appropriate 3D porous scaffolds, would provide the possibility to resurface the joint by grafting biologically and biomechanically competent tissues, obtained with minimal donor site morbidity.The working hypothesis of the proposed research is that human chondrocytes and biomimetic 3D porous scaffolds can be used to engineer functional osteochondral composite tissues, consisting of a cartilaginous layer integrated with an osteoconductive material through an interface containing osteoblast-like cells. Sponges based of collagen type II, a specific component of articular cartilage matrix, will be used to specifically enhance the production of cartilage-specific matrix while scaffolds composed of hydroxyapatite, the main constituent of the inorganic phase of bone tissue, will be used to induce chondrocytes to express characteristic features of cells resident in the bone/cartilage interface.As cell sources we will use not only chondrocytes from articular cartilage (already in clinical use for the repair of articular cartilage defects) but also chondrocytes from nasal cartilage (which can be harvested in a less invasive way and appear to have a more reproducible chondrogenic capacity). The ability of these chondrocyte subtypes to respond to forces which are typically associated with joint loading will be compared.The proposed research is expected to lead to the generation and pre-clinical validation of human cell-based functional osteochondral grafts. Moreover, the interdisciplinary nature of the planned activities will be instrumental to improve fundamental understanding of human chondrocyte differentiation in response to a combination of structural (i.e., specific substrates), and physical factors (i.e., mechanical loading), with expected relevance for understanding/treatment of degenerative joint disorders.

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**Specify cooperation partners**