DESCRIPTION FOR THE GENERAL PUBLIC

Novel treatment methods of articular cartilage injuries are challenging for scientists. Nowadays, joint degenerative changes resulting from articular cartilage defects are the most common disorder of the musculoskeletal system. Osteoarthritis is now the third most common cause of disability in the world's population. Currently the research has focused on the introduction of new surgical techniques and more advanced biomaterials. Recent investigations include modifications of bioabsorbable scaffolds, formed by crosslinking of natural and synthetic fibers (hybridization). Biomaterials are present in medicine for over 70 years. They are commonly used as sutures, bone cement components, and implants used in orthopedic surgery. The field of biomaterials used in clinical practice combines many disciplines, including medicine, biology, engineering, and biotechnology. In 1988, this field of research has gained the name of tissue engineering (TE). TE combines the basic science and engineering technologies in cell and tissue biology in order to regulate growth, differentiation and metabolic activity of the cells. The latest trends in this research area aims at creating a biocompatible scaffold based on natural and synthetic chemical components for the repair of various tissue types. The ideal scaffold should restore, maintain or improve tissue function, which is the main goal of therapy. In the treatment of articular cartilage defects the scaffold should allow the proliferation of cartilage cells in the site of injury, while preserving the unique properties of chondrocytes. The repaired tissue, in the three-dimensional (3D) form, could therefore more easily integrate with the surrounding cartilage.

The aim of our project is to develop new biocompatible scaffolds for cartilage reconstruction based on multi-walled carbon nanotubes (MWCNTs). Most studies indicate good properties of carbon fibers as a cell carriers. In our project, we plan to create a carbon scaffold for cartilage cell growth. The physico-chemical and biomechanical features of the biomaterial will be characterized, cytotoxicity and cancerogenicity will be evaluated. In the final part MWCNTs scaffold suitability for use as a cell carrier for the treatment of cartilage damage in an animal model will be evaluated. Through our research it will be possible to develop a new biomaterial that can serve as a carrier of cells in the regeneration of articular cartilage.