Gene Activated Matrices for Bone and Cartilage Regeneration in Arthritis

This consortium develops a novel gene-activated matrix platform for bone and cartilage repair with a focus on osteoarthritis-related tissue damage. The S&T objectives of this project are complemented with an innovative program of public outreach, actively linking patients and society to the evolvement of this project. The GAMBA platform is going to implement a concept of spatiotemporal control of regenerative bioactivity on command and demand. A gene-activated matrix is a biomaterial with embedded gene vectors that will genetically modify cells embedded in the matrix. The platform comprises modules that self-adapt to the biological environment and that can be independently addressed with endogenous biological and exogenous physical or pharmacological stimuli, resulting in a temporally and spatially coordinated growth factor gene expression pattern. This reproduces, within the matrix, key elements of natural tissue formation. The modules are a biomimetic hyaluronan gel, a ceramic matrix, growth factor-encoding gene vector nanoparticles, magnetic nanoparticles and mesenchymal stem cells. Anatomical adaptivity is achieved with engineered thermal properties of the polymer matrix, which embeds other modules, selected according to functional requirements. Mechanical support is provided by Micro Macroporous Biphasic Calcium Phosphate (MBCP™), a resorbable material approved for clinical use. Spatiotemporal control of bioactivity and responsiveness to physiological conditions is represented, firstly, in the spatial distribution and release profiles of gene vectors within the composite matrix and, secondly, by letting local and external biological or physical stimuli activate the promoters driving the expression of vector-encoded transgenes. This innovative concept is implemented by a multidisciplinary team from leading European institutions combining scientific excellence with a focused plan of dissemination, public participation, gender equality and transition to market.

See current news about the project in the public GAMBA Project Discussion Room .