DESCRIPTION FOR THE GENERAL PUBLIC

Development of the novel biomaterials designed to serve in bone tissue engineering still represents a significant challenge to current regenerative medical research. In this field scaffolds for tissue reconstruction have been extensively studied since there is a need for these materials to offer new therapeutic opportunities for the repair of bones damaged by trauma, diseases as well as aging process.

Considering that fact, the fabrication of two main types of **novel multicomponent materials** for **bone tissue regeneration** is proposed within this project. They are:

1. **hydrogel materials fabricated with the idea of being applied in injectable state.** They will be based on the crosslinked with genipin biopolymers and incorporated to the sols **carriers of biologically active compounds (Fig. 1A):**

2. **mineralized 3-D scaffolds** obtained by lyophilization of biopolymeric hydrogels crosslinked with genipin and mineralized in simulated body fluid (SBF) dedicated for application in the solid form with swellability inside the bone defect **(Fig. 1B):**

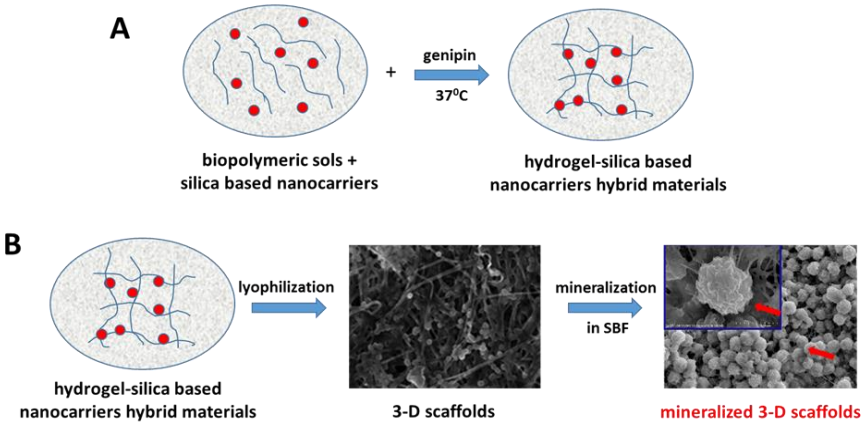

Figure 1. Schematic illustration of the fabrication of injectable hybrid materials (A), 3-D mineralized solid scaffold with swellability (B).

Developed materials will be based on biopolymeric hydrogels composed of collagen, chitosan and hyaluronic acid and dispersed in:

- **bioactive phase** (in the form of hybrid obtained by deposition of hydroxyapatite on the surface of silica nanoparticles. Hydroxyapatite is the main inorganic component of bone and teeth. It is frequently used clinically as a bioactive and biocompatible material with the ability to support biointegration of implants of both hard and soft tissue).
- **compound supporting the differentiation of stem cells into osteoblasts** (in the form of osteoinductive bone morphogenetic protein, BMP-2. BMP-2 possesses an ability to induce bone formation. It will be introduced to the system being immobilized on carrier ensuring biological activity of protein and reducing its doses while increasing efficiency of function).
- **drug inhibiting bone resorption** (alendronate is a drug widely used for treatment of bone diseases, such as osteoporosis, Paget's diseases. It will be introduced to developed system employing method based on its affinity to hydroxyapatite. This approach will ensure its local activity in defined part of bone tissues increasing thus the efficacy of therapy while reducing drawbacks connected with its oral delivery and systemic activity).

These multifunctional system will mimic the architecture, chemical composition and structural properties of the natural bone tissue while simultaneously having osteoinductive and therapeutic characteristics. The biocompatibility of resulted multicomponent hybrids will be tested towards various cell lines (fibroblasts, osteoblasts). Their viability, proliferation, adhesion as well as morphology will be explored. In the last step of the studies the hybrid scaffolds developed will be examined in respect to stimulation of proliferation and differentiation of human mesenchymal stem cells (hMSC) towards osteoblasts.