With development of our civilization demands of our society are growing, not only in relation to the standards of life, but also to the quality and efficacy of treatment of different diseases. In addition, stress, pollution, unhealthy lifestyle, life span increase contribute to the development of various diseases and injuries. For this reason new techniques of treatment are needed and more advanced solutions such as tissue engineering and regenerative medicine are a must. Tissue engineering was proposed in early 90s of the last century, and in its classical meaning it is based on three dimensional scaffolds (of the size similar to the defect) on which cells are seeded, cultured *in vitro* and finally these cell/material constructs are implanted into tissue defects of the patient. On the other hand novel approach called "*bottom-up*" tissue engineering is based on small cell/tissue modules that are assembled and form larger tissue units. Thanks to this, created neo-tissue is better adopted to the treated defect and obtained tissue equivalent is more matured than in the case of classical tissue engineering. As a result probability to achieve fast and better effects of the treatment is higher.

The aim of the project is to develop and optimize manufacturing method of cell microcarriers form resorbable polymer. The microcarriers having the form of microspheres will meet the requirements of biomaterials for "*bottom-up"* tissue engineering. They will be prepared by water/oil emulsification so parameters such as concentration or volume of the surfactant and polymer, temperature and method of the addition of polymer to surfactant will be easily controlled. As a results the microspheres with defined size (150-200 μm and 300-400 μm) and small size distribution will be received. Afterwards the microspheres will be submitted to surface modification: microstructure and surface chemistry. The microstructure will be modified by addition of porogen (pore forming agent) and on the surface of the microspheres bioactive molecules will be attached. The applied modifications will improve cell adhesion, proliferation and differentiation. Finally *in vitro* studies will be performed on various cells found in skeletal tissues (osteoblasts, chondrocytes and mesenchymal stem cells). Tests on mesenchymal stem cells will provide information if the microspheres themselves and/or applied modifications influence cell osteogenic and/or chondrogenic differentiation. It will provide data if obtained tissue has the potential to support tissue formation within the defect in the organism.

Research carried out in the project will contribute to the development of a new field of tissue engineering called "*bottom-up*" tissue engineering. Final result will be elaboration of microspheres with optimal biological properties. Our research will provide required information and will be the basis to perform in the future *in vitro* tests (on laboratory animals), clinical trials and finally our microparticles could be used in patients suffering from bone and cartilage tissue diseases.