The main goal of the project is to design, synthesis, and studies of the properties of innovative scaffolds for tissue regeneration prepared exclusively from natural materials. The advantage of natural building blocks to create new scaffolds results from the requirements of the materials structures used for tissue regeneration: biocompatibility, biodegradability / bio-resorbability, bio-neutrality of biodegradation products, lack of cytotoxicity, desirable mechanical properties. The resulting scaffolds will be used as a temporary synthetic equivalents of the natural extracellular matrix (ECM) allowing cell interactions leading finally to acceleration of the recovery process and regeneration of the damaged tissue. According to the project, achieving all of these properties will be possible by applying natural components only based on polypeptides and polysaccharides. Application of these building blocks for the preparation of three-dimensional materials should ensure completely biocompatibility of the temporary extracellular matrix equivalent, thus offering construct resembling a natural milieu for the cells and finally regeneration of tissues. According to the project, materials used for scaffolds after deposition of cells, their adhesion, proliferation and differentiation, then followed by steady biodegradation leading solely to natural metabolites: amino acids, monosaccharides, oligopeptides, oligosaccharides, all simultaneously being successively replaced by natural components of the ECM. The accurate condition for a normal process of tissue regeneration depends on the several elements cooperating with each other. First of all, these include framework with elements stimulating adhesion of *in vitro* grown cells, growth factors, hormones and vitamins offered as a completed ingredients in the commercially available culture media. An application of 3D frameworks for cell growing should facilitate formation of required tissue shape and size but it is also essential for appropriate functioning of the cells. Process of tissue (organs) reconstruction proceeds in several separate stages in precisely defined sequence. It is believed, that the key factor for the success of the regeneration of tissues is the function of the scaffold determining creation of the enivironment for growing cells, directing proliferation and regulating differentiation processes. In the absence of natural scaffold, or absence of its artificial substitute, regeneration is not possible. Therefore in the case of several injuries the only chance for regeneration of the tissue and healing the wound is implementation of the artificial extracellular matrix into damaged organ. It is believed, that the basic feature of the cellular scaffold, determining its functioning is porosity. Pore diameter and their abundance consists a critical factor for penetration of cells into the interior of the implant and in the end result, successful regeneration of damaged tissue. The progress of tissue regeneration *in vitro* depends not only on the presence of scaffold and cells, but also on the presence of cytokines and growth factors, which are controlling cell differentiation process. In recent times neither of implant material offered on the market has a property comparable to the natural tissue. In case of all polymeric/ceramic commercially available materials, a compromise is reached for the curtailed list of parameters, which should be taken into consideration when biomaterial for tissue regeneration is evaluated. The conclusion arising from the above state of the knowledge is, that practically all materials used for tissue regeneration have several weak points or even obstructive properties, among them the most important is the fact, that there are not made from the natural components. On the other hand there are many reports presenting preliminary experiments conducted towards attaining materials for regenerative medicine from peptides by their self-organization. The most advanced of them are materials formed by self-organization of amphiphilic peptides (AP) known under trade name PuraMatrix, which recently were applied for the regeneration of soft tissues. However, due to tendency of this materials for hydrogels formation, characteristic for them are disadvantageous mechanical properties. Evaluating an alternative approach based on application of native ECM proteins (or more precisely, the fragments of native ECM proteins), it should be taken into consideration. The weak points of this materials are the susceptibility of proteins towards proteolytic enzymes, immunogenic properties, and others. Taking into account all this information the most favorable seems to be amalgamated approach for designing tissue regenerating materials involving all components of ECM i.e. collagen fraction, non-collagen fraction, and carbohydrate matrix, supplemented with growth factors, cytokines and other signaling compounds required for in the process of tissue regeneration. Therefore, the main point of this project is to formulate innovative material for regenerative medicine by mimicking components and 3D structure of native ECM. It is expected to design and to construct new polysaccharide-polypeptide hybrid materials, which should mimic both carbohydrate and proteinic components of the matrix. In order to overcome restrictions created mainly by immunological system in the case of application of protein materials, substantial constituent of them will be formed by self-organization of the short non-immunogenic peptides. The studies will include verification experiments for several classes of self-organizing peptides mimicking protein fraction of ECM. Multidimensional *in vitro* studies will be proceeded to identify all basic features which determine influence of this new material on regeneration process. The results of the project will generate a substantial impact for developing science. The achieved progress will be multifaceted, due to the interdisciplinary nature of the project. Without any doubts the problem of "repairing" of the human body has always evoked an intrerest of researchers because this area represents the future of regenerative medicine.