The main goal of the project is to design, synthesize and investigate the properties of **new, biocompatible, multi-component hybrid materials** useful in the treatment of non-healing wounds, including diabetic foot syndrome, based on immobilized, on the **polysaccharide** matrix, a **set of selected biologically active peptides** derived from proteins affecting all stages of the process of healing wounds. In addition, due to the selection of all the components, the final hybrid materials should stimulate all stages of the wound healing process, thereby providing the basis for a holistic wound treatment tool. The obtained multicomponent hybrid materials should meet all the criteria of a uniform concept for treating chronic wounds - TIME strategy (Tissue debridement, Infection and inflammation control, Moisture balance, Epidermation stimulation), the aim of which is to restore optimal biochemical, physical and microbiological conditions by removing barriers, correcting disorders affecting the lack of healing and strengthening the potential of natural wound healing processes.

In the group of diseases occurring with the formation of difficult to heal wounds, the most common changes include wounds of the lower limbs. These include vascular wounds (venous leg ulcers, ischemic wounds during atherosclerosis, and venous-ischemic mixed wounds), diabetic foot syndrome, and trophic ulcers (decubitus ulcers). Others include immune and haematological wounds, wounds in purulent gangrenous dermatitis, cancer ulcers and wounds accompanying congenital vascular malformations. The problem of diabetes can affect up to 3 million people in Poland. The diabetic foot syndrome is one of the most common causes of hospitalization among diabetic complications and affects about 4-10% of patients. This is responsible for about 5% of chronic wounds, in Poland this problem affects 10% of people with diabetes. The risk of ulceration in a diabetic person ranges from 12 to 25%. It is also the most common non-traumatic cause of amputation in the lower limbs. The risk of amputation in the population of people with diabetes is even 30-40 times higher than in the general population. It is estimated that about 20% of hospitalizations for the purpose of performing amputation concern patients with diagnosed diabetes with complications in the area of peripheral circulation. The **research hypothesis** assumes that as a result of the **synergy** between the selected set of biologically active peptides and polysaccharides, it will be possible to design and obtain a new generation of hybrid materials useful in the treatment of low-healing wounds that will affect (i) hemostasis; (ii) inflammation; (iii) proliferation and (iv) tissue re-modeling. Obtained materials will have the appropriate three-dimensional structure, mechanical strength, flexibility as well as enable influencing the processes in all subsequent stages of healing. In addition, due to the structure of new, multi-component hybrid materials, they should biodegrade only to natural compounds: amino acids, monosaccharides, oligopeptides, oligosaccharides. The use of both polypeptides and polysaccharides as components of materials for the preparation of dressing materials ensures total biocompatibility. In the assumed **research methodology**, it is planned to optimize the methods of selecting a set of biologically active peptides by using the SPOT technique allowing simultaneous synthesis of fragments of proteins involved in the healing process, the use of pre-selection process before solid-phase peptide synthesis and peptide conjugates with alginate-chitosan matrix. This action will allow the study of a significant collection of proteins affecting the healing process, and thus the selection of biologically active peptides derived from these proteins. In addition, studies confirming the biological activity of selected compounds at different stages of the process should guarantee the selection of the appropriate set of peptides before the stage of their deposition on the polysaccharide matrix. Successful implementation of extensive research guarantees the experience of managers and contractors of all research groups involved in the implementation of this project. **The impact of research results** on the development of science, and in particular on regenerative medicine, will have a multifaceted nature. The most important seems to be the results of research on the use of natural compounds: polypeptide, polysaccharide and hybrid materials in the rational design of materials useful in wound healing and their implementation in broadly understood regenerative medicine. Systematic research on the selection of peptide fragments of proteins involved in the healing process at all stages will contribute to a better understanding of the processes occurring in the living organism at the molecular level, thus rational design of innovative materials and their wider use. With regard to the assumptions, the final materials would be new hybrid materials containing a set of selected peptides assuring the biological action at all stages of the healing process, deposited on a saccharide matrix. This approach should guarantee a holistic approach to the problem of wound healing. The obtained results of the project will contribute also to the growth of innovation and the development of science in Poland by naming and resolving complex multi-faceted problem, which of course will have a big impact on the development of science in the world. This will be achieved mainly by the presentations of the results on the conferences and publishing them in international journals. Due to the fact that the project will bring together students from all levels of educational process, it will stimulate the development of young scientists, but also professionals, who will carry innovative approach to problem when attempting to solve important dilemma of industrial centres.