The main objective of the research is to design, obtain and characterize ternary materials based on natural polymers (silk fibroin, collagen, chitosan). Materials will be cross-linked by chitosan dialdehyde. The influence of chitosan dialdehyde on physic-chemical properties of obtained material will be studied.

Most people in the world suffer from diseases related to muscles, joints and bones. Demographic studies indicate an aging of population. As a result of these predictions, it is estimated that the number of people with joint and bone diseases will increase. The skeleton is the support of the whole human body, and it is the place where the muscles are attached. The skeleton plays an important role in the movement process, transferring the strength of the muscles, allowing for the movement. It protects the vital organs of the human body from damage. The bone system carries many important functions in the human body, therefore, material engineering, including tissue engineering and reconstructive medicine, develops at an alarming rate. Treatment of bone defects resulting from injuries, infections and diseases is a big challenge for modern science. All the time, we are searching for the best materials for the production of scaffolds that support the regeneration of damaged tissue. Tissue engineering is a science, the aim of which is the use of medical and material engineering knowledge to obtain functional substitutes for damaged human tissues. In response to the needs of tissue engineering, the aim is to try to obtain new materials with features needed to create the ideal material (in terms of biocompatibility, bioresorbability, bioactivity, degradability to non-toxic degradation products).

Treatment of bone defects which are results of traumas, infection, and genetic defects are a big challenge for modern medicine. The main areas of research in biomaterials for regenerative medicine and tissue engineering are the design and manufacturing of tissue scaffolds. Finding new solutions in tissue engineering is of extreme importnace. The latest trend in tissue engineering is the search for mixtures of natural polymers that would demonstrate compatibility with human tissue. Natural polymers are used for the production of three-dimensional tissue scaffolds, due to their degradability to non-toxic components, biocompatibility, bioactivity and bioresorbability. Natural polymers are large molecular compounds found in living organisms, or are produced by living organisms. In this project, the main focus is on the development of new materials that are characterized by a combination of chemical, mechanical and biological features to aid tissue regeneration.

The use of materials from natural sources is extremely important. The compounds obtained as waste from the food industry (chitosan), textile industry (silk fibroin) and occurring in living organisms (collagen) can be used in medicine and pharmaceutical industry. Biopolymers obtained from natural sources meet the criterion of compatibility with human tissue, and can be used in material engineering, one of which is tissue engineering. Tissue engineering engages in technical and natural sciences, and seeks to find biological substitutes to help restore, maintain and/or improve the function of tissues. Composites made up of biopolymer mixtures can be used to produce scaffolds for human cells that serve to temporarily replace damaged tissue. This work can be very useful because of the new materials that will be designed, and the use of natural resources for this purpose. Materials from such compounds can be used for biomedical purposes in tissue engineering. The combination of silk fibroin, collagen and chitosan is a completely innovative approach to the creation of material that can be potentially used in tissue engineering. The cross-linking materials by chitosan dialdehyde is a novelty in biomedical research.