The term “diseases of affluence” describes diseases (e.g. type 2 diabetes (T2D), obesity, osteoporosis) and other health conditions associated with wealthy lifestyle, environmental contamination, and aging of the world's population. According to the World Health Organization, T2D accounts for around 90% of all diabetes cases in the world. The development of T2D is a major cause of organ damage, especially blindness, kidney failure, heart attracts, stroke and lower limb amputation. Overweight and abdominal obesity, have the main impact on the rapid worldwide rise of the prevalence of T2D. Obesity is associated with a metabolic syndrome that is also responsible for developing cardiovascular disease. It was also confirmed that obesity is strongly associated with a higher incidence of the majority of cancers in humans. The clinical trials revealed that most of the drugs resulted in a modest weight loss, of 3-8% compared to placebo. It was also found that there are some disadvantages of bariatric surgery such as long-term vitamin and mineral deficiencies and reduced drug absorption. In the osteoporosis, the low mass of bone, degradation of bone tissue, and dysfunction of the microarchitecture of bone occurring deteriorate the bone strength and increase the risk of fracture. Carbohydrate and lipid metabolism plays the important role in the development of T2D and obesity, whereas the deficiency of estrogen, phosphate, calcium, and active-form of vitamin D (calcitriol) are the important factors in osteoporosis development.

Human fibroblast growth factors (FGFs) are a family of proteins involving in regulation the biological responses of cells, angiogenesis, regeneration of damaged tissue, wound healing and metabolism of lipids, sugars, and fats etc. FGF 21 protein possesses favorable metabolic effect on insulin, glucose, lipid metabolism, promotes insulin sensitivity. The concentration of the FGF 21 increases in T2D and FGF 21 concentration is inversely related to insulin sensitivity. FGF 23 is responsible for phosphate reabsorption and calcitriol metabolism and in the estrogen treatment, the concentration of FGF 23 significantly increases. FGF21 protein can be considered as a novel and attractive therapeutic agent that can be applied in early detection of the glucose intolerance, leading to T2D, and tendency towards obesity. The determination of the concentration of FGF 23 might be considered as the novel and attractive tool allowing for early diagnosis of osteoporosis. Both of FGF 21 and FGF 23 can be applied in tissue engineering for reparation and regeneration of tissues, in intelligent implants or in accelerating the healing of acute and chronic wounds.

However, the recent studies revealed that FGFs cannot be directly applied because free- FGFs are easily degradable *in vivo*, and their biological activity is irreversibly lost. Thus, in the novel targeted delivering system, FGF can be immobilized on biocompatible carriers (biocompatible polyelectrolytes), forming a drug- carrier complex. Then, the carriers will transport FGFs to target and protect them from degradation and reduce renal clearance. Because of the presence of a large number of surface functional groups biocompatible polyelectrolytes, in particular, various polysaccharides, forming multilayers (biomaterial) can be exploited as nano scaffold for adsorption of biologically active FGFs.

The main aims of the research project are the following: to develop a quantitative description of adsorption of biocompatible polyelectrolytes, of various charges, shapes, and polydispersity indexes, forming the anchoring layers on solid/liquid interface that allows forming effective biomaterials (polysaccharide-based multilayers) with defined structures; to determine the adsorption process and stability of various biomaterials, created by sequential adsorption of oppositely charged polyelectrolytes, under well-defined conditions of shear flows; to clarify the mechanisms of the proteins binding with various types of biomaterials served as biocompatible scaffold; to evaluate the process of release of FGF 21 and FGF 23 from the biomaterials in various shear flow conditions; and to calculate the protein-carrier binding energy. This allows to elaborate the effective method for delivering and release of the active FGF 21 and FGF 23 that is of great significance to the diagnostics and treatment of diseases of affluence.

The proposed research methods enable a complete physicochemical characteristic of the polyelectrolytes in bulk and their multilayers at solid/ electrolyte interfaces. Diffusion coefficients and electrophoretic mobilities of the polyelectrolytes will be measured by dynamic light scattering and electrophoresis. The diffusion coefficients and electrophoretic mobilities allow one to determine the hydrodynamic diameters, zeta potentials, and the electrokinetic charge that are of vital importance for the bulk characterization the polyelectrolytes. Streaming potential measurements, optical waveguide lightmode spectroscopy (OWLS), gravimetric method (quartz crystal microbalance with dissipation (QCM-D)), atomic force microscopy (AFM) will be applied to determine of the process of formation and stability of polyelectrolyte multilayers and FGF binding to/ release from the biomaterials. The experimentally determined kinetics of the polyelectrolyte adsorption and the stability will be interpreted theoretically in terms of the hybrid RSA model using original computer software.

These investigations will promote the development of the research methodology useful for determining the process of formation of new polysaccharide-based biomaterials under *in situ* conditions. The planned research will allow a deeper insight into the mechanisms of the protein binding to biomaterials. This knowledge is exploited to define the relevant physicochemical parameters ensuring effective immobilization and release of the biologically active FGFs.