Cardiovascular diseases are a group of various illnesses, which in the last few years occupied **the first place among leading causes of death**, thereby discrediting cancer. The modern lifestyle has contributed to lowering the age of patients with first symptoms of venous insufficiency. The thrombosis could be classified to this group of diseases. The main cause of thrombosis is the formation of a clot in the site of damage of the veins epithelium caused by chronic inflammation. This leads to a reduction in the diameter of the blood vessel, which may decrease blood flow in the affected part of the body. In acute cases, the clot may be detached causing a pulmonary embolism, what results in patient death.

The respiratory diseases occupy the 3rd position in the mortality statistics just after cardiovascular diseases and cancer. This class of diseases includes asthma, pneumoconiosis, cystic fibrosis, chronic obstructive pulmonary disease and respiratory allergies. The lung tissue damage resulting from chronic inflammation, increasing permeability of the lung capillaries for blood components and stimulation of the proliferation of certain classes of cells including fibroblasts are the main cause of these conditions. As a result, the reduction of the airway lumen and the failure of the system occur.

The appearance of both diseases is connected with detrimental action of thrombin. This serum multifunctional serine protease is a crucial coagulant factor that converts fibrinogen into fibrin. Thrombin also exhibits proliferation properties and can regulate the growth, proliferation and migration of several different types of cells such as fibroblast and epithelial smooth muscle. With respect to above data, **the thrombin seems to be the perfect target for anticoagulant and antiproliferative therapy.** The representative of nucleic acids, which have proven antithrombin properties is a thrombin binding aptamer (TBA). This DNA molecule inhibits the activity of thrombin *via* binding to its exosite I.

The main goal of the project is to investigate the influence of novel unlocked nucleic acids derivatives, introduced into defined TBA positions, on its thermodynamic, structural and biological properties. Application of nucleic acids in therapies is extremely beneficial due to theirs reversible action and relatively easy production. What is more, these properties can be improved through chemical modification of a sugar and/or heterocyclic base fragments.

An important expectation is that the studies will **provide basic information about the properties of novel UNA derivatives on thermodynamic, structural and biological properties of nucleic acids, but also will bring potential therapeutic benefits.** The realization of the above aims will contribute to a detailed recognition of the processes and mechanisms at the molecular level. **The results could also allow to design new inhibitors of thrombin activity as well as aptamers with increased biological stability, what simultaneously would result in the improvement of therapeutic methods.** What is more, **TBA will be used for the first time to inhibit fibroblast growth.** The proposed research fit perfectly in the current trend of designing and synthesis of compounds for therapeutic application.