Cancer diseases are considered one of the major civilization problems. Due to the lack of the specific diagnostic methods, cancer diseases are detected at advanced stages, which reduce the patients' survival rate. Prostate cancer (CaP) is one of the most common one, which can be characterized by high mortality. Frequently, CaP is diagnosed in men above the age of 60, while after the age of 80 is known to be diagnosed in up to 80% of man. Although, there are several CaP diagnostic methods, its early detection is still problematic, as a consequence of non-specific symptoms.

Routine CaP diagnosis is based on four basic and quite simple methods, namely: digital rectal examination (DRE), ultrasound prostate test, biopsy and the determination of known prostate markers' level. In routine examination focused on CaP detection, *per rectum* examination and determination of PSA is performed.

In routine, basic test, the diagnostic criterion of CaP is based on PSA blood concentration, which should not be greater than 4 ng/mL for healthy man over 50 years of age. On the one hand this method is painless and relatively simple. On the other hand, PSA is known as a specific marker for pathophysiological prostate condition however nonspecific for CaP**.** For this reason clinical significance of PSA determination is still discussed. In case of increased level of PSA, a patient is referred for a biopsy which confirms the presence of cancer cells only in 25% of cases. For this reason PSA is not recommended in routine medical tests aimed at proper diagnosis of prostate cancer. The increased level of PSA may indicate not only tumor growth, but also may be a symptom of infection or benign prostatic hypertrophy.

Among the factors predisposing to CaP development, biochemical and etiological conditions may be distinguished. Within etiological ones: diet, age, genetics, lifestyle and race can be found as major indicators which strongly influence CaP development. In the group of biochemical factors, the role of hormones, metabolites, proteins and fatty compounds, can be distinguished. In order to recognize the molecular mechanism of CaP development there is still a need to conduct further investigation. The mechanism can be recognized via comprehensive studies in which the impact of the potential CaP indicators and their interrelation will be tested.

One of the relatively new approach which can be used to explain the mechanism of cancer disease development is lipidomics. Lipidomics is focused on determination of fatty compounds in a variety of biological samples. Nowadays, researchers hope that among fatty compounds potential, undiscovered CaP indicators can be identified. For this reason within the scope of the project, lipidomic analysis will be carried out in order to determine the lipidomic profiles of CaP.

Moreover studies on correlation between changes in the concentration of potential CaP indicators and tumor stage , will be performed. In the proposed project, three biological materials, namely blood, urine and tissue will be analyzed with the use of liquid chromatography, gas chromatography and capillary electrophoresis. Urine can be collected noninvasively, blood can be obtained easily, however, in case of tissue collection, controlling intrinsic changes is possible. In the first step of the project concentration of PSA, hormones and biochemical indicators in biological samples will be analyzed. Lipidomic analysis, will be composed of untargeted analysis followed by targeted one. Analyzed biological samples will be collected from patients with diagnosed CaP and non-cancer individuals (control group). Fingerprinting lipidomic analysis will be carried out in order to determine all fatty compounds present in prostate tissue samples.

In the second phase of the project, targeted lipidomic analyses of selected compounds will be performed. The influence of tumor grade on metabolites' quantitative profile will be also taken into account. In this part of the study, two types of biological matrices, namely blood and urine, will be analyzed to confirm the results from tissue extracts analysis and propose less invasive diagnostic and prognostic matrices. Finally, an attempt to find correlations between changes in lipidomic profiles and molecular mechanisms of CaP will be undertaken.

The obtained results should provide insight into understanding specific pathomechanisms of CaP development, which is still not well explained.