Physical exercise is known to trigger a wide range of mechanisms leading to specific adaptations in the human body. Endurance training influences the musculoskeletal, respiratory and cardiovascular system (CVS), among others. Guidelines of the European Society of Cardiology define the amount of sport that is beneficial for CVS, however some athletes far exceed exercise volume defined in these recommendations by engaging in long-lasting training and ultra-endurance competitions. Such an intense training may induce not only physiological adaptations but also adverse changes in CVS and even in the heart itself by impairing its structure, electrical activity, or function, and making its phenotype similar to that seen in pathological states. Recent reports pointed out the influence of exercise on the levels of non-coding RNA (ncRNA) levels, i.e. microRNA (miRNA) and long non-coding RNA (lncRNA) which influence gene expression.

In our study we aim to evaluate the utility of specific ncRNAs along with biochemical biomarkers related with endurance exercise and potential impact of high intensity exercise on expression of ncRNAs related to physiological and pathophysiological changes in CVS in a unique population of high-level long-term ultra-marathon runners compared to controls with a sedentary lifestyle. MiRNAs and lncRNA have the ability to post-transcriptionally regulate gene expressions. They have an advantage over traditional disease biomarkers as i) they reflect specific cellular pathophysiological alterations; ii) experimental evidence suggests that they potentially indicate the specific mechanisms causing pathological changes in CVS iii) they could potentially allow early diagnosis and/or the identification of subjects at risk before they develop pathological changes in CVS.

To our best knowledge, there is no experimental study that aimed to assess the utility of miRNAs and lncRNAs as biomarkers in a cohort of endurance athletes using NGS. The current data on the role of endurance training on CVS pathologies are fragmentary, leaving this field still unexplored. NcRNAs and their targets associated with endurance exercise identified for the first time in this study based on both bioinformatic analysis and NGS can serve as potential biomarkers helping with identification of the pathological changes in the CVS.

We will use the samples collected from individuals participating in the 100 km ultra-marathon on flat terrain, which took place on 10th November 2018 at the University of Physical Education in Warsaw, along with samples from mild trainers and individuals with a sedentary lifestyle. In order to conduct this study we will i) extract the total RNA of all plasma samples and perform total RNA NGS, ii) run bioinformatic analysis to analyze the data and select the most promising biomarkers, iii) perform statistical analysis.

We expect that identification of novel biomarkers, such as miRNAs and lncRNAs, can be useful in exercise evaluation together with differentiation between beneficial adaptive changes and exercise induced pathology. A better understanding of these processes can improve our knowledge of exercise physiology and guide the development of exercise analytics in clinical practice. Specific adaptations may be beneficial when they occur in relation to the training of moderate intensity, and pathological when caused by high-endurance exercise. It is worth emphasizing that processes related to the development of exercise-induced changes can be similar, if not the same, as those responsible for the development of CVDs. That is why research focused on athletes may be useful in CVDs detection, prevention and treatment.