

Cancer is one of the world's deadliest human diseases and the rate of its incidence increases every year. Cancer cells can generate all the energy necessary to carry out the most important life functions by metabolizing glucose to lactate, even in aerobic conditions. This behavior is different in comparison with the metabolism of healthy cells, which produce energy by oxidative phosphorylation (in mitochondria), or when access to oxygen is limited, by anaerobic glycolysis. The German biochemist Otto Warburg first observed and described this phenomenon, which was later termed Warburg effect or aerobic glycolysis. Despite of the many studies of the Warburg effect, this phenomenon has not been fully explained yet.

The glycolysis inhibitors act as to perturb the Warburg effect, thus showing some beneficial therapeutic outcomes due to the blocking of the main metabolic pathway of tumor development, leading to the diminished drug resistance and increased prospects for curing the disease.

The motivation for this Project is to design novel biosensing techniques offering a potential for point-of-care and clinical use for the diagnostics, grading, and treatment of neoplastic diseases. Moreover, better understanding of the reprogramming of energy production, rapid proliferation and growth of cancer cells may also contribute to the development of drugs with selective activity against cancer.

The goal of this Project is to design and test a novel biosensing system based on aptamer for monitoring of metabolic pathways for ATP production in healthy and cancer cells. The obtained biosensing platform will be applied to investigate the effect of different glycolysis inhibitors (e.g. 2-DG, 3BP, apoptolidin A) on the modulation of ATP production in cancer cells. In this Project, the fluorescence spectroscopy and optical microscopy with fluorescence filters will be utilized for the development of the biosensing systems based on ATP aptamers. Moreover, the cell viability tests will be performed using a colorimetric MTT assay.

The novel biosensing system based on aptamers designed in this work will enable us to extend our knowledge about energy metabolism of cancer cells, which is necessary to develop an effective treatment for this deadly disease in the future.