

Ischemia of brain and heart tissue is the one of the most common causes of deaths worldwide. Recent studies have revealed that mitochondria play the crucial role in cellular death. Basic function of mitochondria being cellular power plants is energy production which is used in many processes in the cell. It has been found that ischemia induces mitochondrial damage what promotes cell death. Discovery of natural cytoprotective mechanisms as well as drugs preserving mitochondrial function during ischemia is the goal of many studies.

Channels are regulated pores in biological membranes that allow for ion movement in and out of the cell. Some of these channels let only specific ions through e.g. potassium. Recently, potassium channels have been identified also in mitochondria. These proteins regulate potassium fluxes across the mitochondrial inner membrane. The basic properties of mitochondrial potassium channels have been recognized to be similar to the potassium channels found in the plasma membrane.

It was discovered that activation of mitochondrial potassium channels with pharmacological substances preserves mitochondria against damage induced by various factors including ischemia. However, the mechanism of this phenomenon remains unclear. The properties of ion channels including drug binding are determined not only by proteins that make up their pores but also by so called accessory proteins that bind pore proteins. Many accessory proteins were discovered for potassium channels residing in the cellular membrane but no such studies were carried out for mitochondrial channels. We think that there are specific mitochondrial proteins that bind mitochondrial potassium channels and these proteins could be target for new drugs that modulate potassium channel activity in mitochondrial specific way.

Therefore, the main goal of our project is to discover what are accessory proteins of mitochondrial potassium channels and find out what impact these proteins have on the channel function. To do this we will employ state-of-the-art biochemical, genetic and biophysical methods. At the end of the day we hope our discovery will help to understand the mechanism by which potassium channels protect mitochondria and to design better drugs for ischemia related diseases: heart and brain failure.