Ischemic stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function. It is one of the major causes of death and long-term severe disabilities worldwide. According to the World Health Organization, 15 million people suffer strokes worldwide each year. Moreover, referring to the present pandemic, there is mounting evidence that also patients affected by COVID-19 may develop clinically significant coagulopathy with thromboembolic complications, including ischemic stroke. Therefore, the prevention and treatment of stroke-related brain damage are major and unresolved problems of contemporary medicine.

So far, despite the progress in the understanding of molecular mechanisms of neuronal injury, only a few neuroprotective substances are used in the clinic and their efficiency in the treatment of stroke and ischemia-related disorders is not satisfactory. One of the major limitations to current treatment is an inefficient delivery of neuroprotective drugs to the affected part of the brain and difficulties in the diagnosis if the drug is well addressed, i.e., if it reaches the targeted organ.

Theranostics is a new branch of medicine based on the joining of therapeutic and diagnostic functions in one entity. Application of nanotechnology in theranostics allows engineering of drug carriers simultaneously delivering therapeutic components and possessing a diagnostic function.

The main objective of the project is to develop a new strategy to deliver neuroprotectants by applying theranostic nanocarriers for neuroprotective agents, which can cross the blood-brain barrier without imposing side effects on its normal function and can be detected in a given part of a brain by Nuclear Resonance Imaging (MRI). In the project, we aim to apply various methodologies of encapsulation of neuroprotective drugs together with fluorescent or MRI contrast agents. The size of nanocarriers should not exceed 150 nm; they should be non-toxic, “invisible” to the immune system, able to cross the blood-brain-barrier and can be precisely localized in the affected brain area.

The fluorescently labeled nanocarriers will be used in the *in vitro* cell tests of neuroprotective activity of encapsulated substances and ex vivo test of their localization in the brain, using experimental models of organotypic culture and oxygen glucose deprivation whereas nanocarriers with MRI contrasts will be used in the in vivo tests on animal models of ischemia.

The ultimate aim of the project is the development of new drug carriers that can be used in the future in therapies for ischemic stroke and ischemia-related pathologies. Moreover, beyond the brain disorders, the proposed methodology enables the synthesis of multipurpose nanovehicles for encapsulation of both therapeutics as well as diagnostic MRI contrast agents, potentially useful for developing various targeted therapies (e.g., anti- COVID-19).