Neurodegenerative diseases are becoming an increasing problem in developed countries. This stems largely from longer life expectancy. The second reason is the lack of effective treatments for this group of diseases.

The second most common neurodegenerative disease is Parkinson's disease.

Parkinson's disease may be genetic (5-10% of cases) but can also occur for reasons that are not fully understood (approximately 90% of cases). Genetic mutations that cause Parkinson's disease have been fairly well understood. In contrast, other causes such as environmental impact, activation of the immune system are not fully explored.

Therefore, the aim of this project is to shed new light on the role of other factors that can lead to Parkinson's disease.

The project is also aimed to determine whether the use of cell therapy could help improve the effectiveness of treatment of patients with Parkinson's disease.

In order to answer the questions posed in the project we will use, developed at the Department of Transplantation UJCM, cellular model of Parkinson's disease. Model makes possible to obtain dopamine-producing cells, whose damage is the main cause of Parkinson's disease.

The project will be implemented through studies *in vitro* and *in vivo*.

In *in vitro* studies we focus on the role of mitochondria in the process of Parkinson's disease, with particular emphasis on the role of the microenvironment in the process of mitochondria damage.

In the *in vivo* studies we assess the possibility of using neurons in the treatment of Parkinson's disease. The neurons will be implanted into brains of experimental animals to determine their potential to improve the clinical symptoms of Parkinson's disease. In parallel, we will evaluate, how the modulation of the immune system affects efficacy of treatment using dopaminergic neurons.

The results obtained during the project will expand our knowledge about the mechanisms responsible for the emergence of Parkinson's disease, and in the future may allow the development and introduction to the clinic new, more effective treatments modalities for this condition.

The results obtained during the project could also contribute to the future development of new methods for the treatment of other neurodegenerative diseases, eg. Alzheimer's disease or Huntington's disease.