The central nervous system is one of the least well-known structures in our body. This is due to its complicated structure as well as the constant lack of appropriate research tools.

Damage to brain structures leads to disability and neurological disorders. The causes of brain damage can include mechanical injuries, metabolic disorders, infections or maternal pregnancy poisoning. The currently used treatment do not bring the expected results. The results of pilot studies conducted at the Jagiellonian University Collegium Medicum showed that the administration of autologous stem cells in children with damage to the central nervous system leads to an improvement in the patient's health, including increased motor skills and overall neurological improvement. The aim of the project is to assess the efficacy of treatment with mesenchymal stem cells, and to determine its mechanism of action in the *in vitro* and *in vivo* studies.

In vitro tests will determine the profile of cell secreted proteins that may have potential neuroprotective effects, stimulate neurogenesis and angiogenesis, and determine the role of inflammation inducing pathways on glial cells. The next step will be to evaluate the effectiveness of stem cell and immunomodulation in inhibiting neurodegeneration and stimulation of processes using mice with impaired immune systems that can be infused with human cells.

The processes associated with brain damage leading to both motor and cognitive disorders are only partially recognized. However, the biological aspects of the lack of regeneration at the damaged site and the possibility of interference with this process are unknown. The research proposed in the project, will allow to evaluate the effectiveness of stem cell utilization in the treatment of central nervous system damage and to learn more about the mechanisms responsible for the regeneration processes. Obtained results will allow to develop new treatment options for patients with central nervous system damage, based on cell replacement therapies. They will also help to improve the quality of life of both patients and their families.