# Injury to the nervous system

Neurotrauma often results in permanent damage at the site of the injury that results from the initial trauma as well as by inflammatory and other processes that prevent neuronal regeneration and recovery by the central nervous system. Various cell types and tissues are affected following neurotrauma, including: neurons, astrocytes, microglia, neuroblasts, neural stem/progenitor cells, and the blood brain barrier

Neurons are responsible for the electrical and chemical transmission of information within the nervous system. These cells are very sensitive to the changes of their microenvironment. Following injury to the nervous system, neurons can degenerate and die. This can be due both to direct effects on these cells or through the modification of the properties of the cells and environment around them.

Astrocytes play a prominent role in the control of the neuronal microenvironment within the nervous system, by regulating energy supply, neuronal activity and vulnerability. In particular, astrocytes regulate the extracellular concentration of neurotransmitters, such as glutamate, in the synaptic cleft. Astrocytes can also supply adequate neuronal energy demand. In particular, astrocytes have the ability to regulate glucose and glutamate uptake, as well as secrete neurogenic and pro-inflammatory molecules. These functions contribute to the health and/or vulnerability of neurons observed in physiological and/or pathological conditions. Furthermore, following neural injury, surviving astrocytes in the effected region are activated by inflammatory molecules to undergo rapid proliferation and exhibit hypertrophy, termed reactive astrogliosis, which also has an impact on neuronal survival.

Microglial cells are often characterized as the immune cells of the central nervous system. These cells are mobilized following various pathologies, including brain injuries, neurodegenerative disorders and neuropathic pain. Their activation and mobilization contribute to the global response to the nervous system injury.

In the adult, neuroblasts are derived from proliferative neural stem/progenitor cells in the

sub-ventricular zone. They play an essential role in the adult neurogenesis, in both physiological and pathological conditions. In physiological conditions, they give rise to neurons, migrate, and eventually integrate into the olfactory bulb and hippocampus; while in pathological conditions such as brain injury, they play a role in neurogenesis.

The blood brain barrier acts as a selective barrier between the nervous system and the rest of the body; due to its unique structure of various cell types. The blood brain barrier is a dynamic regulator and facilitator of nutrient and ion transport to the central nervous system and a barrier to protect the central nervous system from harmful agents. Most forms of central nervous system injuries are associated with the disruption of the blood brain barrier. The breakdown of the blood brain barrier allows the entrance of hematopoietic cells, including platelets, from blood stream to the injury site.

Various experimental models are currently used for assessment of neurotrauma, from cell based assays to animal models of trauma. There are many approaches underway to investigate mechanisms to improve neural regeneration and promote functional recovery, including blockage of axonal growth inhibitory molecules, treatment with growth promoting molecules, applying measures to reduce glial scar, and developing methods to limit diffuse inflammation and cell death. Thus, the key to an effective therapy after neural injury is to identify factors which contribute to both acute and secondary events that limit regeneration and functional recovery.