Human immune system is an amazing and precisely working machinery composed of various types of cells which possess different abilities and functions. These cells are our soldiers, militia and police. Immune system protects us from environment invaders like foreign bacteria, parasites, or viruses, as also from our own bacteria that home our body as allies. However, sometimes this precise machine may work incorrectly, recognizing another cells and organs of body as foreign structures. This situation occurs in autoimmune diseases. One of such diseases in which immune system destroys structures in central nervous system is multiple sclerosis (MS). In this disease, development of inflammation in central nervous system leads to progressive neurodegeneration and disability preceded with myelin destruction and slowing in nerve signal transmission. Disease affects mainly young adults, its outcome is usually between 20 and 30 year of life. What is more actually there is no effective treatment, we can only slow down the disease course. These facts support the need for investigating cellular and molecular mechanisms involved in MS development.

In our project we are going to investigate the relations between T helper lymphocytes, which are the major players in brain inflammation, with astrocytes, which are the major not neuronal cells in brain. In physiological conditions astrocytes provides support for neurons, they also communicate with immune system cells, giving them information about the neurons condition, slows down the activity of immune cells, protects neurons from active immune cells. On the other hand activated astrocytes were shown to promote inflammation by attraction of immune cells, as also their activation. These actions may occur on direct and indirect contact. Indirect contact depends on secretion of various proteins and also microRNAs. In our work we will investigate the role of microRNA, secreted in exosomes for mutual astrocytes-lymphocytes interactions. MicroRNAs secreted from proinflammatory, regulatory and resting astrocytes will be identified and their role confirmed. We will also conduct search for exosomal microRNAs produced by lymphocytes and their impact on astrocyte cells. Does the investigations on microRNAs are important? We think so! MicroRNAs are regulators of gene expression, their discovery was awarded with Nobel Prize. Recent investigations revealed the role of microRNA-dependent signaling in many disorders also in MS. However, we do not know too much about the role of microRNAs in exosomes – structures designed especially for cargo transport from cell to cell. Our project is important for understanding the mechanisms of MS development, progress and maintaining and our results may be useful for drug development.