Multiple sclerosis (MS) is a severe and chronic neurological disease, it has autoimmune etiology. Most suffering people are from 20 to 40 years old. MS is one of the leading causes of young people disability. Poland is among the countries with a high incidence of MS, the frequency is over 100 cases / 100 000 people. It is estimated that currently 50-80 thousand in Poland alone and 2.5 million people worldwide suffer from this condition. The disease is incurable, it is one of the most common cause of young people disability. Thus MS presents as a burning problem to every health care system. Fortunately recent decades brought significant progress in understanding of this condition. New methods of molecular and immune techniques have been introduced to study MS. MS is caused by the body own immune system attack to the brain cells, oligodendrocytes. Oligodendrocytes are the source of myelin, a sheath that surround nerve cells. The destruction of myelin leads to severe and irreversible damage to the brain. However several methods of MS treatment have been introduced, none of that is fully satisfactory. Currently only slowdown of the disease progression could be achieved at the cost of the potentially severe adverse reactions. Thus there is a very critical need for the development of the novel, more effective and safer methods of the MS treatment.

T helper cell (CD4+ T cells, Th) are major orchestrators of the immune system response toward myelin. A Th subtype,Th17 is responsible for guiding the brain damage. However not every Th17 cell is deleterious. Therefore there is a need to know, how to distinguish the harmful, disease causing Th17 (pathogenic) from a benign and even beneficial non-pathogenic Th17 that e.g. protect from infections. Organism's own methods of pathogenic containment could also be utilized to stop Th17 cells. Natural immunosuppressive lymphocytes, T-regulatory type 1 cells (Tr1) normally balance pathogenic Th17. The aim of this project is to study in detail the mechanisms of the pathogenic Th17 and protective Tr1 development and differentiation. Our previous research have indicated that a novel area of biology, investigating an unclassical methods of genetic information execution, epigenetics, is likely to profoundly change our understanding of the Th17 and Tr1 cells function. With this regard we have been successful in investigating the role of short non-protein coding RNA, microRNA in the pathogenesis of autoimmune demyelination. This research has led to discovery of several previously unknown pathways of pathogenic Th development. We propose to here to extend our research of non-coding RNA to the detailed analysis of the role of long non-protein coding RNA – lncRNA in the development of pathogenic Th17 and protective Tr1. To this end we will employ a panel of cutting-edge genetic, molecular, bioinformatics and functional techniques to unravel new mechanisms of the myelin targeted destruction. We will use the animal model of MS, experimental autoimmune encephalomyelitis, EAE. This will enable us not only to investigate the pathways leading to the disease, but also to test the efficacy of the new methods of immune system modulation arising from this project findings. Thus our proposal has a high translational research value. We believe that our project will help us to understand mechanisms of MS as well as to design new, better, more efficient and safer methods of this condition treatment.