Millions of people worldwide suffer from severe visual illness caused by retinal photoreceptor degeneration. Over 2,5 million of them suffer from currently incurable Retinitis Pigmentosa (RP) disease, where the loss affects the peripheral retina in the progressive peripheral to central manner, causing the limitation of the field of view to small central field of vision, “tunnel vision”.

In daily life, central visual information processed in higher brain structures is associated with conscious sharp vision. Whereas, information from the visual periphery makes us aware of things which might happen, bringing those which our peripheral visual system will find important to the central visual processing, into the scope of further conscious and detailed analysis. The visual system is retinotopically organized, that is neighboring cortical regions respond to neighboring points in visual space. We undoubtedly know that these orderly maps are not static but instead remain malleable throughout life. Evidence for such plasticity in the mature sensory systems, comes from sensory deprivation or specific sensory stimulation of these systems. Such manipulations force the cortical neurons to deal with a specifically new sensory environment and cause changes of their molecular composition and, consequently, their signaling and functional properties.

Here we assume that in RP patients, plasticity of the peripheral vision cortical representations rests on intact information arriving to the central retina. We predict, that neurons, or cortical areas driven by central retina, can allocate their properties to the peripheral counterpart. As we demonstrated in our recent animal model of human central retinal loss, the plasticity of the peripheries was observed after central retinal loss. Therefore, we plan to compare reorganizations triggered by juvenile central loss of photoreceptors in patients with Stargardt disease with matched onset of illness and duration to our RP patient group. We plan to examine central and peripheral processing using designed by us novel acuity task based on motion perception. Brain region activations during presentation of visual stimuli will be examined with functional magnetic resonance imaging. We shall also investigate structure of white matter connections between visual regions of the brain and measure the volume of brain regions involved in vision. We aim to explain plasticity events in RP and STGD syndromes, which although affecting different regions of retina may similarly recruit motion processing regions in the cortex. The results of this project will add a new dimension to understanding plasticity of the adult brain.