Vision provides the reception of information from the external environment; therefore, it is crucial for maintaining a high quality of life, however, an estimated 285 million people are vision-impaired, and 39 million people worldwide are blind. Visual impairments are characterized by poor vision or blindness in a way that cannot be corrected. The predominant cause of those conditions is an irreversible deterioration of light-detecting photoreceptors: rods and cones. The number of visually impaired people is increasing, and this trend will continue as the population ages. This dramatically impacts the lives of those affected, making daily activities difficult and leading to a loss of independence. That is why it is crucial to look for solutions that can form the basis of vision disorder therapies that slow down the disease progression and restore vision. To date, various approaches have been used to restore some visual functions in affected patients, primarily human-derived retinal organoids and gene therapies. First directly administered Adeno-associated virus (AAV) based gene therapy approved by U.S. Food and Drug Administration (FDA), Luxturna, significantly improved the vision of patients with retinal dystrophy at low light levels.

Nevertheless, there are still difficulties with restoring high-resolution vision that need to be overcome. **is project aims to develop a novel proof-of-concept approach to therapeutic gene delivery using a modified Rabies virus as a vector specific to bipolar cells.** We propose that specific targeting of the surviving cell population within the degenerated retina, especially bipolar cells (BC) by our modified Rabies virus (RV), pseudotyped with LRIT3 (RV-LRIT3), may constitute a new strategy of gene therapy in retinal diseases. We hypothesize that the proposed viral approach can reach many BCs thanks to the interactions with the TRPM1 channels and deliver high levels of light-gated opsins to restore vision. The main innovation of this project is using the RV, which can transfect up to 4 genes. Therefore, it can be used to deliver opsins with different excitation spectrums and increase overall light sensitivity. We suggest this technique will restore selective responses in the mice's visual cortex and superior colliculus. We will utilize single-neuron recordings and behavioral visual discrimination tasks to estimate visual network selectivity in response to complex and moving stimuli.