Vision is an essential sense in our life. Without good sight, we cannot function properly, and our quality of life is significantly decreased. Therefore there is a strong need to understand how our brain processes visual information and how different brain structures interact with each other. Lack of such interaction would not be able to perform an attentive task or to memorize visual tasks. One of the structures heavily involved in cognitive processes and general brain activity is a Basal Forebrain (BF). This project is designed to investigate the Basal Forebrain's role in visual information processing. The BF is the primary source of cholinergic inputs into the visual cortex, and therefore the main source of the acetylcholine neurotransmitter. We propose that cholinergic modulation coming from BF will significantly impact single neuronal responses of the primary visual cortex (V1) in Long-Evans rats. Precisely, we hypothesize that the BF cholinergic modulation will change single cells' stimulus preference like optimal size, orientation selectivity. Furthermore, it will have an even stronger impact on the visual system activity by changing the oscillations carrying information through the sensory systems.

Moreover, we will attempt to reveal if only cholinergic inputs directly affect single cells in the V1 or there is needed additional involvement of GABAergic cells in the Basal Forebrain. In this aim, we will use newly developed viral tools to target GABAergic or cholinergic cells in the BF specifically. By using opsins we will manipulate basal forebrain activity and correlate it with encoding happening in the V1. The opsins are proteins that can be activated by particular light color. We also hypothesize that such manipulations will significantly impact behavioral performance and pattern recognition due to more robust activity while performing attentive tasks.