

## **CHOLINERGIC DEPENDENCE OF A COGNITIVE TASK**

*Nikolaos C. Aggelopoulos<sup>\*</sup>, Timothy Melano, Nikos K. Logothetis, Gregor Rainer*

Max Planck Institute for Biological Cybernetics, Tübingen, Germany

<sup>\*</sup>aggelopoulos@tuebingen.mpg.de

Acetylcholine (ACh) is a neurotransmitter implicated in several cognitive functions and is believed to especially affect the acquisition of new information. Learning adapts behavior to new situations and to new categories of stimuli.

We have examined the effects of scopolamine, an antagonist of muscarinic ACh receptors, on object categorization. Extensive behavioral pharmacological studies were carried out in two macaques. Performance was disrupted following injections of scopolamine. When the stimuli presented were novel, ie. when they had not been seen before the experiment, scopolamine significantly impaired performance in the categorization task. The monkeys were less impaired in categorizing a set of familiar stimuli, ie. stimuli that they had categorized successfully in previous sessions. Performance also deteriorated as the stimulus became less salient by an increase in the level of visual noise.

One of the questions of the role of cholinergic neurons in networks involved in the learning of new stimuli and in the performance of the categorization task is the type of information that they convey. Our recordings are aimed towards making the study of information in these networks feasible through simultaneous recordings of several neurons during the performance of a complex behavioral task requiring responses to a series of discrete stimuli at parametrically varied salience levels, belonging to two categories and two familiarity levels.

In addition to the behavioral experiments, neuronal activity was recorded in one monkey during a fixation task in which the monkey was presented with stimuli belonging to two categories. Preliminary recordings of neuronal ensembles have been made using tetrodes or polytrodes in the putamen, globus pallidus and nucleus basalis. All these regions have cholinergic neurons. Whereas cholinergic neurons in the basal ganglia are interneurons involved in local networks, their role is likely to be important as the basal ganglia are a crucial component in a circuit that underpins learning of conditional tasks. The nucleus basalis and other regions of the basal forebrain, on the other hand, have cholinergic neurons that project to the amygdala, hippocampus and cerebral cortex and are considered essential components in a variety of cognitive behaviors, including the formation of new memories. Neurons in the putamen had no visual responses but they anticipated the reward at the end of each trial. Neurons in the globus pallidus and the nucleus basalis were also reward predicting but could have in addition visual responses. These responses are related to the task performed by the monkey and may be important in the performance of the categorization task, in which case the prediction would be that the responses would be affected when categorization is impaired by scopolamine.