

## **Description for the General Public**

When I look at an apple, my brain processes information about its individual features (e.g. surface colour, edges, shine), my conscious experience of it is rich in details but consistent, not divided into pieces. At what stage of processing perceptual information is formed into a holistic, conscious experience of an apple? Why does one person experience it differently than the other? What are its neuronal underpinnings?

The discovery of the biological basis of consciousness is one of the most important challenges of modern neuroscience. For over 30 years, research has been carried out to identify neuronal correlates of consciousness (NCC), that is brain activity, which co-occurs with conscious experience, but they remain unidentified. Some researchers believe that consciousness is associated with the early stages of perception coupled with an activity of brain occipital areas, while many others maintain that it requires an engagement of frontal lobes. In recent years, the methodological aspects of previous research were challenged. One of the reasons is that most of the NCC research requires participants to report content of their conscious experience. Therefore, it cannot be ruled out, that what is considered to be NCC is in fact a correlate of the process that follows the already shaped conscious experience of a given stimulus in order to assess internal state and provide a reliable report. The proposed project aims to identify the proper NCCs, i.e. not what precedes (e.g. identification of the stimulus) or follows them (e.g. its evaluation). For this purpose, advanced methods of structural and functional neuroimaging as well as transcranial magnetic stimulation will be used and compared with the results of a set of computer tasks.

Previous studies focussed primarily on visual perception, ignoring other sensory modalities, as well as important for conscious process, integration of information from various modalities. In addition, NCC were investigated usually with single task, not taking into account the specifics of the research procedure design, type of stimuli used or variability in participants' ability to consciously perceive. Finally, the research groups were usually small, which affected the credibility of their results. The goal of the proposed project is to overcome these limitations by applying a set of various computer tasks (near threshold, bistable perception and perceptual illusion tasks) that allows to estimate the spectrum of perceptual abilities in a large number of participants. Use of a set of diverse tasks and neuroimaging of a large group of people will allow for a precise description of the neuronal basis of conscious experience, as well as analysis of individual differences that correspond not only to variability in the performance of the task, but also affect the process that shape conscious experience. In addition, non-invasive brain stimulation will allow to answer whether modulation of neuronal activity in a given brain area influences conscious experience, such studies are not only correlative, but allow for inference about the causal relationship, which is a significant and progressive complement to the data obtained with use of neuroimaging.