Our everyday life is composed of a variety of tasks that we need to execute either in sequence or at the same time. The ability to perform these tasks is based on a type of memory called Working Memory (WM), which could be called the “thinking stage ground” of our mind. WM maintains information in an easily accessible state for short periods of time. It refers to maintaining information in the awareness when this information is not present in the environment in order to use it for future goal-directed behavior and allow us to act beyond the boundaries of the here and now. Importantly, WM is frequently burdened with numerous everyday cognitive challenges. For instance, often, during the performance of one task, something unexpected happens, and we need to switch our attention to a different task (e.g., someone will call us when we are packing to work). Due to the fact that our working memory is able to maintain the information outside of focus of attention, most of us, after ending the call, will be able to come back to the packing and complete the task which was interrupted. Interestingly people which have damage to part of the brain called the Medial Temporal Lobe will be unable to come back to the previous task after interference. This suggests that Medial Temporal Lobe is crucial for maintaining information that dropped outside of our focus of attention. Surprisingly we know very little about how the neuronal networks inside our human brains make it happen. This is because direct recordings of neurons in the human brain are very difficult. It is possible only during the treatment of different diseases when we need to put electrodes into the human brain because of clinical reasons.

This project will take advantage of a unique opportunity to directly record the activity of human neurons in Medial Temporal Lobe during the procedure of invasive epilepsy monitoring. We will record the activity of those neurons when subjects will need to maintain information about one task and complete a second interference task. This, for the first time, will characterize the activity of neurons in Medial Temporal Lobe when the subject needs to constantly switch attention between different goals. Using this approach, we hope to pinpoint the exact role of maintenance activity in the Medial Temporal Lobe.

The result of this project will give us a much better understanding of neuronal mechanisms supporting Working Memory. This will inspire new ideas for treatments of many neurological and psychiatric diseases like ADHD, schizophrenia, or depression as they are characterized by WM disturbance.