



Proyecto PID2022-137527NB-I00 financiado por MCIN/AEI/10.13039/501100011033/ y por FEDER Una manera de hacer Europa

Identificación del proyecto:

Formación y consolidación de la memoria en humanos (MemForm)

Descripción del proyecto:

When we meet a person for the first time, our brain creates a memory of this person that may last for years to come. But what are the mechanisms that form this neural representation, and how does this representation evolve in time and consolidates as the person becomes more familiar after several encounters?

In spite of the relevance of these questions, we still have relatively limited knowledge of the neuronal machinery that underlies the formation of new memories. A major limitation is that, on the one hand, non-invasive recording techniques (e.g. EEG/MEG, fMRI) are used with human subjects for obvious ethical reasons, but while these methods have provided insights on the activation of brain areas during different tasks, they can only offer an indirect and vague measure of the activity of neurons. On the other hand, invasive recordings, which provide direct access to study the firing of multiple neurons, can usually only be performed in animals. However, the types of experiments and questions that can be addressed with animals are limited, as they need extensive reward-driven training, far from the natural conditions of how memories are created in real-life situations.

Our overall goal is to study the mechanisms of memory formation and consolidation in humans who, in contrast to other animals, can perform memory tasks and give detailed feedback of their thoughts and recollections without the need of prior (reward-driven) training. For this, we will profit from the unique opportunity to record the activity of multiple single neurons in human subjects, implanted with intracranial electrodes (in the key memory area) for clinical reasons, while they perform memory tasks.

The proposed experiments will explore the neural mechanisms of memory formation by tracking the firing of neurons while memories are created and consolidated. In particular, we will analyze the activity of neurons while the subjects familiarize themselves with initially unknown faces after repeated presentations. Moreover, to study memory formation in more natural situations, we will track the activity of neurons while the subjects watch initially unknown and very engaging movies, thus studying how the neurons encode the different movie characters as they become familiar.

Experiments will be repeated twice a day (after a few hours break) and in consecutive days, to assess the stability and plasticity of the neurons responses. Furthermore, experiments will be

complemented by specific questionnaires to determine the nature of memories encoded by the neurons, such as their emotional saliency or the triggering of specific recollections.

Altogether, we will describe for the first time the neural machinery that is involved in creating and consolidating new memories. Besides the scientific impact, this project also has important clinical connotations. In fact, the basic understanding of how memories are physiologically embedded in the human brain can give us new insights into future treatments for conditions involving memory problems, such as Alzheimer disease. In advanced stages, Alzheimer patients cannot establish new memories, so the study of the mechanisms of memory formation, with direct neuronal recordings in a human population, can have an extraordinary academic and clinical value.

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218.750,00€

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