Hospital del Mar Research Institute Barcelona

Nota de prensa

Possible Foundations of Human Intelligence Observed for the First Time

- ***A study led by Dr. Rodrigo Quian Quiroga has demonstrated how neurons in the human brain generate memories and establish narratives. The research is published in the journal Cell Reports.***
- ***For the first time, it has been confirmed that, contrary to previous beliefs, individual neurons represent the concepts we learn, regardless of the context in which we encounter them.***
- ***This allows humans, unlike other animals, to establish higher and more abstract relationships, which lays the foundation of human intelligence.***

Barcelona, March 6th, 2025. –A study led by Dr. Rodrigo Quian Quiroga, group leader of the Neural Mechanisms of Perception and Memory Research Group at the Hospital del Mar Research Institute, has allowed scientists to observe for the first time **how neurons in the human brain store memories** independent of context in which they are acquired. Published in Cell Reports, the study confirms that neurons **can distinguish objects or people** regardless of their context, enabling the formation of higher and more abstract relationships, which constitutes the **basis of human intelligence.**

This is the first study to observe this neuronal behavior in humans. Until now, research conducted on animals had shown significant differences in the coding of concepts (such as a specific place, object, etc.) when the context changed. For example, neurons responded very differently if a rat found an object in one location versus another. As a result, it was believed that such memories were stored in different groups of neurons. The study led by Dr. Quian Quiroga has yielded "**surprising responses**" that contradict previous findings, as neuronal responses to a specific concept remain the same when the context changes, such as remembering having seen a person in different locations. "**The basic principle of neuronal coding in humans is the opposite of what has been observed in other species, which has significant implications**," notes Quian Quiroga.

Single Neuron Data

The study involved data from nine patients in Argentina and the United Kingdom with treatment for refractory epilepsy, who had electrodes implanted to monitor the activity of specific groups of **neurons individually**. This allowed researchers to obtain precise recordings of their responses, unlike previous human studies based on fMRI recording, which cannot differentiate individual neurons.

Patients were presented with two stories featuring the same person in different contexts, supported by images. Thanks to the monitoring of individual neurons while performing this task, researchers could observe **which groups of neurons were activated and how they responded in the two stories**. Specifically, they confirmed that if a neuron responded to a person's image, **the response remained the same** in both stories. Furthermore, when patients recounted the story themselves, the same neurons were activated seconds before they referred to the protagonist, and also in the same way for both stories.

"Memories are stored in a much more abstract manner in humans compared to other animals. You can think of concepts or anything else in more abstract terms, independent of the context in which you learned them," explains Dr. Quian Quiroga, suggesting that this could be one of the **"foundations of human intelligence." "This ability**

allows us to make much more abstract and complex associations and inferences than if we were forced to think of each concept within a specific, concrete context," he asserts. In other words, humans can decontextualize their memories to create more abstract thought.

Reference Article

Rey HG, Panagiotaropoulos TI, Gutierrez L, Chaure FJ, Nasimbera A, Cordisco S, Nishida F, Valentin A, Alarcon G, Richardson MP, Kochen S, Quian Quiroga R. Lack of context modulation in human single neuron responses in the medial temporal lobe. Cell Rep. 2025 Jan 28;44(1):115218. doi: 10.1016/j.celrep.2024.115218. Epub 2025 Jan 15. PMID: 39823228; PMCID: PMC11781864.

More Information

Hospital del Mar Research Institute/Hospital del Mar Communications Service: Marta Calsina 93 3160680 mcalsina@researchmar.net, David Collantes 600402785 dcollantes@hmar.cat