

# Small groups of brain cells store concepts for memory formation– from Luke Skywalker to your grandmother

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Concepts in our minds – from Luke Skywalker to our grandmother - are represented by their own distinct group of neurons, according to new research involving a University of Leicester neuroscientist.

The research, by University of Leicester neuroscientist Professor Rodrigo Quian Quiroga together with Professor Itzhak Fried, of the UCLA David Geffen School of Medicine, Tel Aviv Sourasky Medical Center and Tel Aviv University, and Professor Christof Koch, of the California Institute of Technology and Allen Institute for [Brain Science](#), Seattle, is featured in a recent article of the Scientific American magazine.

Recent experiments during brain surgeries have shown that small groups of [brain cells](#) are responsible for encoding memories of specific people or objects.

These [neurons](#) may also represent different variations of one thing – from the name of a person to their appearance from many different viewpoints.

The researchers believe that single [concepts](#) may be held in as little as thousands of neurons or less – a tiny fraction of the billion or so neurons contained in the medial temporal lobe, which is a memory related structure within the brain.

The group were able to monitor the [brain activity](#) of consenting patients undergoing surgery to treat epilepsy. This allowed the team to monitor the activity of single neurons in conscious patients while they looked at images on laptop screens, creating and recalling memories.

In previous experiments, they had found that single neurons would 'fire' for specific concepts – such as Luke Skywalker – even when they were viewing images of him from different angles or simply hearing or reading his name.

They have also found that single neurons can also fire to related people and objects – for instance, the neuron that responded to Luke Skywalker also fired to Yoda, another Jedi from Star Wars.

They argue that relatively small groups of neurons hold concepts like Luke Skywalker and that related concepts such as Yoda are held by some but not all of the same neurons. At the same time, a completely separate set of neurons would hold an unrelated concept like Jennifer Aniston.

The group believes this partially overlapping representation of related concepts are the neural underpinnings of encoding associations, a key memory function.

Professor Quian Quiroga said: "After the first thrill when finding neurons in the human hippocampus with such remarkable firing characteristics, converging evidence from experiments we have been carrying out in the last years suggests that we may be hitting one of the key mechanisms of memory formation and recall.

"The abstract representation of concepts provided by these neurons is indeed ideal for representing the meaning of the sensory stimuli around us, the internal representation we use to form and retrieve memories.

These concepts cells, we believe, are the building blocks of memory functions."

Provided by University of Leicester

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