Studies show that the cerebellum is crucial to understanding vulnerability to drug addiction

23 February 2017

An international research team led by the Universitat Jaume I (UJI) has shown that the cerebellum, contrary to previous thought, fulfills functions that go beyond the motor sphere and can be co-responsible for the brain alterations associated with addictive consumption of drugs. The findings, which are shown in two recent reviews published in *Neuroscience & Biobehavioral Reviews* and *Journal of Neuroscience* represent a step toward the design of new therapies.

According to researcher Marta Miquel, the studies show that changes in the cerebellum "only occur in those subjects who appear to be especially vulnerable to the effect of drugs." She adds, "We have verified that the cerebellum responds in a very potent way to the effect of cocaine, to the point of changing the mechanisms of plasticity."

Consequently, the cerebellum is relevant to understanding and designing future treatments for drug addiction. "There is progress in describing the neuronal circuits affected by drug addiction, a chronic brain disorder that is difficult to treat because it affects the basic processes of acquiring and storing the information whose description is still incomplete," explains the teacher.

Addiction involves alterations in the neuronal mechanisms of plasticity that allow the brain to store information, regenerate itself and recover from possible disorders or injuries. In an addicted person, there is a malfunction in the brain's mechanisms of learning and memory that allow decision making and acts of will. Addictive drugs force the brain to store harmful data about where, when and how to consume the substance. In fact, the drug is the predominant information in the brains of people affected by addiction.

The effects of cocaine

The current studies address the function of the cerebellum in storage processes involved in addictive disorder. Specifically, "experimental work shows that these effects of cocaine on cerebellar function only occur in those individuals dominated by stimuli that predict drug availability and suggest that the cerebellum may be crucial to understanding mechanisms of vulnerability to addiction," explains Marta Miquel.

Science has corroborated that certain regions of the brain, such as the prefrontal cortex, amygdala, hippocampus, and basal ganglia, may be relevant for addiction. However, the cerebellum had traditionally been excluded from this circuit because it was considered a structure exclusively dedicated to motor control, especially motor coordination. "Today we know that this is a very partial view on the complexity of the cerebellum, and a growing volume of data suggests its involvement in many of the brain functions affected in addicted subjects," says Marta Miquel. "The cerebellum comprises 80 percent of all neurons in the brain; it contains 60 billion neurons packaged in only 10 percent of the brain mass and is a fundamental structure in the consolidation and automation of learned behavioural repertoires," she concludes.

More information: Marta Miquel et al. Have we been ignoring the elephant in the room? Seven arguments for considering the cerebellum as part of addiction circuitry, *Neuroscience & Biobehavioral Reviews* (2016). DOI: 10.1016/j.neubiorev.2015.11.005

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