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A world first:
Douglas Institute researchers identify the neural circuits that modulate REM sleep

Montreal, Wesnesday, October 02, 2013 – A team of scientists led by Dr. Antoine Adamantidis, a researcher at the Douglas Mental Health University Institute and an assistant professor at McGill University, has released the findings from their latest study, which will appear in the October issue of the prestigious scientific journal *Nature Neuroscience*.(1)

Previous studies had established an association between the activity of certain types of neurons and the phase of sleep known as REM (rapid eye movement). Researchers on the team of Dr. Antoine Adamantidis identified, for the first time, a precise causal link between neuronal activity in the lateral hypothalamus (LH) and the state of REM sleep. Using optogenetics, they were able to induce REM sleep in mice and modulate the duration of this sleep phase by activating the neuronal network in this area of the brain.

This achievement is an important contribution to the understanding of sleep mechanisms in the brains of mammals, as well as the underlying neuronal network, which is still not well understood despite recent breakthroughs in neuroscience.

Better understanding how sleep is modulated to reduce sleep disorders

“These research findings could help us better grasp how the brain controls sleep and better understand the role of sleep in humans. These results could also lead to new therapeutic strategies to treat sleep disorders along with associated neuropsychiatric problems,” stated Dr. Antoine Adamantidis, who is also the Canada Research Chair in Neural Circuits and Optogenetics.

What is REM (rapid eye movement) sleep?

There are two types of sleep: REM and non-REM sleep. In humans, non-REM sleep has four stages. REM sleep, or deep sleep, is generally associated with dreaming and is a phase when the brain is very active, even though people are in a heavy sleep, their eyes move rapidly (hence the name), and their bodies have an almost total loss of muscle tonus (2).

Although our understanding of the mechanisms that control the wake and sleep cycle has progressed in recent years, many frontiers remain unexplored. However, we do know that a disruption in sleep can lead to adverse effects on physical and mental health in humans.

Optogenetics, a revolutionary technology

In 2010 in the journal *Nature*, optogenetics was recognized as one of the coming decade's most promising techniques to better understand brain function. This new field of research and application integrates optics and genetics methodologies to modulate the activity of neural circuits. Optogenetics involves controlling neuronal activity with light. This technique is therefore used to manipulate a specific type of cell without affecting neighbouring cells. A researcher who uses optogenetics is therefore like a conductor who decides to change the sheet music for an instrument to observe the effects, however insignificant they may seem, on the orchestra's entire performance.

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(1) Optogenetic identification of a rapid-eye-movement (REM) sleep modulatory circuit in the hypothalamus. Sonia Jego, Stephen D. Glasgow, Carolina Gutierrez Herrera, Mats Ekstrand2, Sean J. Reed, Richard Boyce, Jeffrey Friedman, Denis Burdakov & Antoine R. Adamantidis.

(2)Le Sommeil et vous, Mieux dormir, mieux vivre. Diane B. Boivin, MD, PhD, Éditions du Trécarré, 2012, 192 p. Diane Boivin is a clinician and researcher and the Director of the Centre for Study and Treatment of Circadian Rhythms at the Douglas Institute.

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Information:
Valérie Bordelais
Communications and Public Affairs
Douglas Mental Health University Institute
Phone: 514-761-6131, extension 2616
Cell: 514-409-8558
valerie.bordelais@douglas.mcgill.ca

About the Douglas – www.douglas.qc.ca