

Failure of brain's clock could play role in causing neuropsychiatric disorders

September 21 2011, By Susan Chaityn Lebovits

(Medical Xpress) -- Neuropsychiatric disorders are the second largest cause of morbidity and premature mortality worldwide. The scientific community has widely accepted that people who battle neuropsychiatric disorders such as depression, obsessive-compulsive disorder, alcohol and substance abuse and hyperactivity disorder can also have poorly regulated biological rhythms, which leads to altered sleep/wake cycles and hormonal rhythms.

But new research shows increasing evidence that these [circadian system](#) symptoms, which have long been considered a result from the pathology of the underlying disease, may also be involved in the cause of [psychiatric disorders](#).

These emerging views originated with the discovery that the genes involved in generating biological rhythms are expressed in many brain structures where clocks function and, perhaps, malfunction.

In a recent issue of Current Opinion in Neurobiology, Brandeis researcher Jerome S. Menet and Professor Michael Rosbash reviewed the current knowledge on this topic and examined a range of research including mice that were working in simulated night shift conditions, and where cell clocks in various parts of their brains were analyzed to see how they were affected. One of the findings revealed that activity was affected within the [hippocampus](#), which is important for memory, and the [amygdala](#), which is important for emotion.

Other experiments involved mice that had been bred to have no internal body clocks, and others subjected mice to 10 hours of darkness then 10 hours of daylight. Results showed that rodents that had a loss of regulation in their [biological rhythms](#) were more prone to drug addiction, hyperactivity, helplessness and [sleep disorders](#).

“Almost all structures in the brain have cell clocks,” says Menet.

“Basically people were trying to disrupt the environmental condition then examine behavior as well as effects on brain clock structure and function.”

These cell clocks, says Menet, receive rhythmic information such as the hormone melatonin, which is secreted at night and regulates sleep/[wake cycles](#). For people who do shift work, cell clocks for the entire body (and therefore within the brain) are affected.

“When you have de-synchronization between your environment and your internal signal, that’s when you start to have problems,” says Menet.

Sleep is controlled by the interaction of two components: a circadian component, which controls the timing of sleep, and a homeostasis component, which reflects sleep need. Circadian rhythms take place over a 24-hour period—not just if there is light and darkness. All organs in the body have internal clocks, such as the liver, heart, lungs, and intestines, which all function over a 24-hour period.

“When the body clock within the liver is off, for example, one may develop metabolic problems such as obesity,” says Menet. “And when the clock within the brain is off one could become more prone to psychiatric disorders.”

According to the paper, aspects of modern life such as shift work leads to activity or food intake during what should be the resting phase. This

causes internal signals to be generated at inappropriate circadian times, which results in a conflictual timing between the internal signals and the still properly timed external environmental signals. In the most pronounced cases, all circadian rhythms of hormones, neuronal outputs and metabolites throughout the body are desynchronized.

Provided by Brandeis University

Citation: Failure of brain's clock could play role in causing neuropsychiatric disorders (2011, September 21) retrieved 3 May 2024 from <https://medicalxpress.com/news/2011-09-failure-brain-clock-role-neuropsychiatric.html>

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