New study demonstrates important role of glia in circadian timing

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Glial cells of the nervous system, once thought to function strictly as support cells for neurons, are now thought to actively modulate them. Providing further evidence in support of this theory, researchers at the Department of Neuroscience and the Center for Neuroscience Research (CNR) at Tufts University School of Medicine (TUSM) recently identified a specific population of glial cells that is required for the control of circadian behavior in Drosophila (the fruit fly).

Their findings, which confirm and extend their earlier work, are published in the August 2, 2007, issue of *Neuron*.

“Our results suggest that an autonomous glial mechanism may drive circadian rhythms in the activity of a Drosophila protein known as Ebony,” says F. Rob Jackson, PhD, director of the CNR and professor of neuroscience at TUSM. “Ebony activity and the glia containing that activity” explains Jackson, “function independently of, or in concert with, other brain cells (neurons) to control circadian behavior.”

“Most organisms,” says Jackson, “from Drosophila to humans, have the ability to adapt the timing of behavior or other processes to environmental cycles using an intrinsic time-keeping device called a circadian clock.” While previous studies have suggested that glia may be required for normal circadian behavior, specific glial factors that are needed for this process had not been identified.

Jackson and his colleague Joowon Suh, a student in the Sackler School of Graduate Biomedical Sciences neuroscience program at Tufts, used cellular and molecular genetic techniques to show that Ebony is localized exclusively in glial cells, and that it is involved in one of the commonly studied rhythmic behaviors observed in Drosophila—locomotor activity. “Not only do our studies indicate that Ebony abundance is under clock control,” Jackson says, “but they also suggest that Ebony may exert its effects on locomotor activity indirectly via a modulation of dopamine neurotransmission.”

Previous studies of Ebony have shown that it has enzymatic activity that promotes the conjugation (a chemical change) of dopamine. “Interestingly,” notes Jackson, “Ebony-containing glia are located in close proximity to dopaminergic neurons in the brains of Drosophila. We propose that glia participate in the clock control of dopaminergic function and the orchestration of circadian activity rhythms. Glia may communicate with neurons of the circadian system and help to coordinate their outputs, which are critical for the temporal control of behavior.

“Our work is the first to identify a defined glial population in any organism that is critical for a behavioral process—in this case, circadian timing,” Jackson states. “Research has not yet demonstrated that glia regulate circadian rhythms in mammals, including humans, but those studies are currently underway in other labs. Everything we know about circadian mechanisms in Drosophila and mammals says that they are quite similar.” He stresses that, although there is much work left to be done, “there are potentially broad implications for understanding the etiology of diseases that are affected by altered biological timing mechanisms, such as the human sleep-wake cycle.”

Source: Tufts University