Circadian surprise: Mechanism of temperature synchronization in drosophila

October 28 2009

New research reveals a pathway that links peripheral sensory tissues with a "clock" in the brain to regulate molecular processes and behaviors in response to cyclical temperature changes. The research, published by Cell Press in the October 29th issue of the journal *Neuron*, reveals some surprising fundamental differences between how light-dark and temperature cycles synchronize the brain clock of the fruit fly, *Drosophila*.

A variety of organisms have evolved an endogenous timing system called a circadian clock to regulate behavioral metabolic activities. "Circadian clocks regulate many biological processes to occur at beneficial times for the organism," explains senior study author, Dr. Ralf Stanewsky from Queen Mary College at the University of London. "Although we know quite a bit about how natural light-dark cycles synchronize the circadian clock of organisms ranging from flies to mammals, little is known about mechanisms of temperature synchronization."

Specifically, it is not known which cells or structures sense temperature changes or how temperature signals reach the brain clock. In an earlier study, Dr. Stanewsky and colleagues identified two mutations in the fruit flies that interfered with temperature synchronization. One of the genes, nocte, was defective in flies that exhibited normal light synchronization but abnormal molecular and behavioral synchronization to temperature.

In the current study, the researchers found that isolated fly brains were able to synchronize to light-dark cycles but were unable to synchronize to temperature cycles. This suggested that in contrast to light-dark synchronization, the brain circadian clock neurons require information from peripheral tissues for temperature synchronization. Importantly, disruption of nocte in peripheral cells also interfered with temperature synchronization.

More specifically, loss of nocte changed the structure and function of major fly sensory organs called chordotonal organs, and had a dramatic influence on temperature synchronization of behavioral activity. Further, other mutants that interfered with the function of the chordotonal organs also disrupted temperature synchronization. This established the chordotonal organs as key circadian temperature receptors.

"Our work reveals surprising and important mechanistic differences between light- and temperature-synchronization and advances our understanding of how clock resetting is accomplished in nature," offers Dr. Stanewsky. "This study demonstrates once again the power of forward genetics in identifying novel factors and mechanisms. Just looking at the nocte DNA sequence, no one would have predicted a function for this gene or the chordotonal organs in temperature synchronization".

Source: Cell Press (news : web)

Citation: Circadian surprise: Mechanism of temperature synchronization in drosophila (2009, October 28) retrieved 10 April 2024 from https://phys.org/news/2009-10-circadian-mechanism-temperature-synchronization-drosophila.html