Clock Genes Encyclopedia Article

Clock Genes

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Clock Genes

Circadian rhythms are fluctuations in biochemical and behavioral activities that occur over a period of about 24 hours. These activities are not simply a light-dark reaction, but are generated by an internal timekeeping mechanism called the circadian clock, apparently related to clock genes. Clocks are present in prokaryotes and **eukaryotes**, the latter including plant, insects and mammals.

Work using *Drosophila* has identified genes called period (per) and timeless (tim), whose disruption can speed up, slow down or destroy the circadian clock. The proteins coded for by per and tim function in a negative feedback loop, which likely forms the oscillation (rest-active) part of the timing system. The levels of the per and tim proteins oscillate in a regular pattern. This oscillation controls the activity of various genes, modulating the expression of the per and tim genes.

Parallels found between *Drosophila* and both mouse and humans show that **evolution** has conserved not only the property of circadian timing but also its molecular basis. In humans and other mammals the primary body clock is located in a cluster of neurons called the suprachiasmatic nuclei, located behind the optic nerve. It is this light-sensitive location which may determine how per and tim are synchronized to the outside world.

The daily clock is crucial for longer-term processes in many animals. Migration, hibernation, fattening, and fur growth are adaptations to winter. Events such as the annual rut of large animals and the summer population increase of smaller animals are cued months in advance by the change in light patterns. The circadian clock is central to these effects.

Circadian rhythms are important for humans as well. Seasonal changes in mood affect some. Now, evidence is accumulating that seasonal changes in body physiology are more wide spread.

Recent experimental results using fruit flies with defective clock genes indicate that the genes could influence more than circadian rhythms. Failure to respond to narcotics, leading to their abuse, may be one consequence of defective clock genes.