Circadian clock neurons presumably involved in photoperiodism in the blowfly *Protophormia terraenovae*

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Many insects respond to photoperiod to control their life cycles, and enter diapause before severe seasons. Various studies suggest that circadian clock mechanisms are involved in photoperiodic responses. However, there is no evidence for this at a neural level. In the present study roles of circadian clock neurons in the photoperiodic response were examined in the blowfly *Protophormia terraenovae*. Under short- and long-day conditions the mRNA levels of *period* oscillated in the brain, and the oscillations persisted under constant darkness. Five types of PERIOD-immunoreactive cells were revealed. Among them four pairs of large ventral lateral neurons (l-LN_vs) and small ventral lateral neurons (s-LN_vs) were double-labelled with antisera against pigment-dispersing factor (PDF) and PERIOD. When the anterior base of the medulla in the optic lobe, where l-LN_vs and s-LN_vs are located, was bilaterally ablated, 55% of flies showed arrhythmic or obscure activity patterns under constant darkness. Percentages of flies exhibiting rhythmicity decreased along with the number of s-LN_vs. When regions containing s-LN_vs were bilaterally ablated, flies did not discriminate photoperiod. The results suggest that circadian clock neurons, s-LN_vs, driving behavioral rhythms might also be involved in photoperiodism, and that circadian behavioral rhythms and photoperiodism share neural elements in their underlying mechanisms.