Discovery of early rising effect of a ketogenic diet on mice
A low-carbohydrate diet affects the circadian clock

We have found that the circadian clock of mice can be controlled by feeding a low-carbohydrate diet. A low-carbohydrate, ketogenic diet was administered to mice for 14 days and subsequently, the expression of a clock gene which is a marker of the biological clock was analyzed. The clock gene was expressed 4 to 8 hours earlier in the mice on low-carbohydrate diet than in the control mice. Since a mouse is a nocturnal rodent and its circadian rhythms are strongly influenced by light, it is difficult to observe the behavior of mice in a light-dark (day-night) cycle environment. Hence, the mice were placed in constant darkness and the effects of the diet on their behavioral patterns were recorded. The mice on the low-carbohydrate diet woke up earlier (i.e., they became early risers) than the control mice. The forward shift of activities was also observed in the case of mice with DSPS (delayed sleep-phase syndrome; mice with DSPS tend to oversleep), who were fed the low-carbohydrate diet. We anticipate that this low-carbohydrate ketogenic dietary treatment would be a new therapy for sleep disorders or jet lag.

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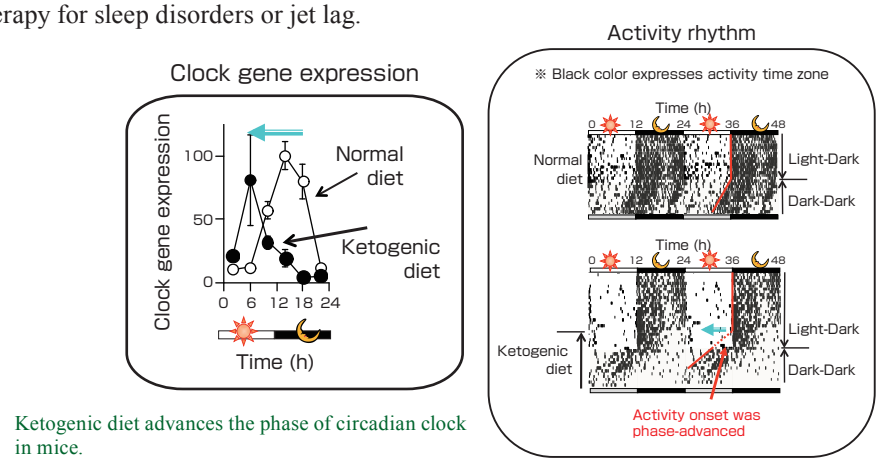
AIST TODAY Vol.9 No.11 p.20 (2009)



Ketogenic diet advances the phase of circadian clock in mice.

An invisible-light-entrainment mechanism of the *Drosophila* circadian rhythm
Re-entrainment of *Drosophila* rhodopsin mutants to red-LED light

Like most other insects, *Drosophila* visual system is insensitive to red light. However, *Drosophila* circadian rhythms can be entrained by red light. Here, we discovered the corresponding organs and rhodopsins responsible for the circadian entrainment of *Drosophila* to red light using rhodopsin mutants and red light emitting diodes (LEDs). The entrainment by red light was not observed in eyeless mutants of *Drosophila*. We also found that double Rhodopsin 1 (Rh1) and Rhodopsin 6 (Rh6) mutants were not entrained to red light, while single Rh1 mutants and single Rh6 mutants were both entrained to red light. These results indicate that *Drosophila* can entrain the circadian rhythm to red LED light through Rh1 and Rh6 in compound eyes.

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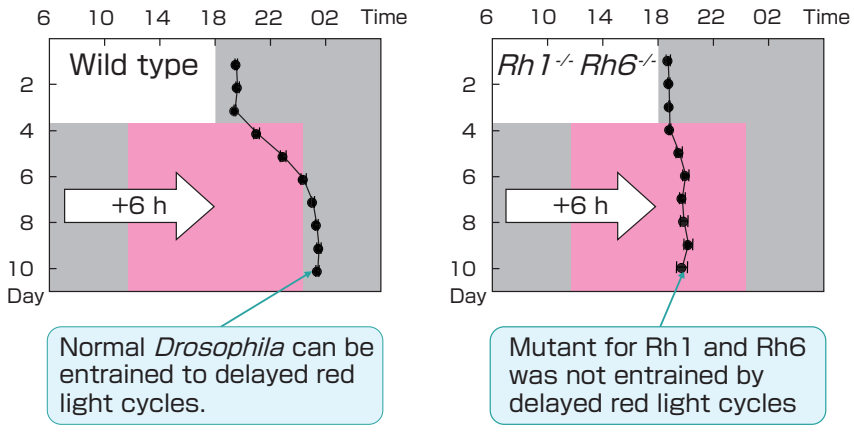
AIST TODAY Vol.9 No.12 p.18 (2009)



Entrainment of normal and rhodopsin mutant by red light
Off-set of locomotor activity was shown