

Research highlights

Neuroscience: Insights into why we feel jetlag?

Human biochemical processes are controlled by internal body clocks with an approximately 24 h period—circadian rhythms. In mammals, the suprachiasmatic nucleus (SCN) contains self-sustained circadian oscillator as master pacemakers. The expression of clock gene *Period1* (*Per1*) oscillates autonomously in the SCN and is induced immediately after a light pulse. *Per1* is an indispensable member of the central clock system, since the constitutive expression of *Per1* in the SCN modifies physiological and behavioral rhythms [1]. The SCN and peripheral tissues are compared about the ability of phase shift using realtime monitoring system from same animal.

Now, Shin Yamazaki, Rika Numano, Michikazu Abe and colleagues at University of Virginia and University of Tokyo constructed *Per1:luc* Tg rats in which firefly luciferase was rhythmically expressed under the control of the mouse *Per1* promoter [2].

Rhythmic emission from the cultured *Per1:luc* SCN slices persisted for some months *in vitro*, while those from peripheral tissues such as the liver damped after two to seven cycles. These results show that a self-sustained circadian pacemaker in the SCN entrains circadian oscillators in the periphery.

Next, the researchers compared the phase shift ability of light and dark (LD) cycles between the SCN and peripheral tissues. The phase-shifting paradigm is closely analogous to trans-Atlantic flights from west to east (6 h advance) and from east to west (6 h delay).

The emissional rhythms in the SCN shifted 6 h most rapidly within one day, while those in peripheral tissues took more than two days. Circadian oscillators in the periphery were temporarily lost following large and abrupt shifts in the environmental light cycle.

Notably, jetlag can be explained as a condition where the rhythms in the SCN and peripheral tissues are desynchronized.

[1] Rika Numano *et al.*, *Proc. Natl. Acad. Sci. U S A*, **103**, 3716, (2006)

[2] Shin Yamazaki^{1*}, Rika Numano^{2*}, Michikazu Abe^{1*}, Akiko Hida², Ri-ichi Takahashi³, Masatsugu Ueda³, Gene D. Block¹, Yoshiyuki Sakaki², Michael Menaker¹, Hajime Tei² *These authors contributed equally to this work.

Resetting central and peripheral circadian oscillators in transgenic rats.

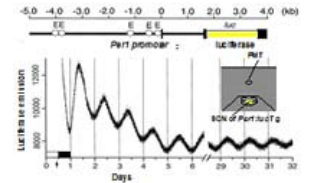
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Rhythmic emission in the SCN of *Per1:luc* Tg rats