Mammalian Behaviors under the Control of Circadian Clock

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The circadian transcription of *Per1*, a mammalian clock gene, is observed in both the central circadian clock (SCN) and peripheral tissues (liver, muscle, and lung) with a tissue specific manner. The results indicate that the oscillation of *Per1* can be utilized as a molecular marker of tickling clocks in both tissues. We constructed transgenic rat lines with a *Per1::luc* reporter. Light emission from the cultured SCN of these rats was robustly rhythmic for up to 30 days *in vitro*. However, cultured liver, lung and skeletal muscle tissues expressed circadian rhythms that damped after 2-6 cycles. The circadian rhythm of light emission from the SCN followed light cycle shifts within 1 day. The result made a striking contrast with the facts that the entrainment of the rhythms of locomoter behavior and peripheral tissues after the light cycle shifts completed at least in 3-7 days. For elucidation of the molecular mechanisms controlling the oscillation of *Per1* expression, stable transfectants of mouse NIH3T3 cells with a series of deletion and point mutants of the m*Per1::luc* reporter were established. Five E-boxes in the m*Per1* promoter was necessary for the *Per1* oscillation. Furthermore, affected circadian phenotypes in the SCN of transgenic rats with *Per1* overexpression will be presented, and a molecular mechanism constituting the genetic pendulum in central and peripheral circadian rhythms will be discussed.