

Mathematical approach to jet lag

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Jet-lag symptoms arise from temporal mismatch between the internal circadian clock and external solar time. We know by experience that it takes about one week to recover from jet lag (i.e., reentrainment) after a long-distance trip. We recently reported in [1] that, in mice lacking the receptors of a certain neurotransmitter (KO mice), circadian rhythms of behavior and clock gene expression rhythms immediately reentrained to phase-shifted light-dark (LD) cycles. Experiments indicate that oscillation of clock gene expression in wild type mice significantly weakens after a large phase shift, whereas that in KO mice is robust. To uncover the mechanism underlying jet lag symptoms, we constructed a mathematical model consisting of multiple oscillators. In this presentation, after giving an overview of the experimental study, I will explain how our model uncovers the mystery that lack in neurotransmitter results in the quick response to jet lag.

Reference

1. Y. Yamaguchi, T. Suzuki, Y. Mizoro, H. Kori, K. Okada, Y. Chen, J.M. Fustin, F. Yamazaki, N. Mizuguchi, J. Zhang, X. Dong, G. Tsujimoto, Y. Okuno, M. Doi, H. Okamura: Mice Genetically Deficient in Vasopressin V1a and V1b Receptors Are Resistant to Jet Lag, *Science* 342, pp. 85-90 (2013).