The Circuit Mechanisms of SCN-mediated Seasonal Prolactin Response in Rodents

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1. Objective

The suprachiasmatic nucleus (SCN) in the anterior hypothalamus, best known as the central circadian pacemaker, serves as a seasonal clock that encodes day-length information. It synchronizes many physiological rhythms by sending humoral and neural signals to peripheral clocks to trigger adaptive seasonal responses. While seasonal physiology and behavioral patterns have been studied in various mammals, the neural mechanism of how different photoperiods affect rodents' seasonal clock is uncertain. In this study, we address the SCN circuit that transforms long-time-scale photoperiodic information into seasonal prolactin responses and assess the photoperiodic influences on SCN neuronal output that engage rodents' hormonal and phenotypic responses.

2. Methods

Djungarian hamsters (*P. sungorus*), which exhibit prolactin-regulated seasonal pelage replacement cycles under seasonal lighting paradigms, are used to study seasonal neuroendocrine physiology in addition to C57BL6 mice. We imposed skeleton periods to verify if discrete light periods are sufficient to elicit the daylength-induced hair color switch of *P. sungorus* and analyzed grayscale mean intensities at different stages of the seasonal molting. Coincident prolactin level changes were evaluated by ELISA. To define the prolactin-regulating candidates in the hypothalamus of both rodents, we immunostained candidate SCN neural populations and their intra-hypothalamic targets that vary under different seasonal light conditions. Neurons identified by IHC markers were quantified by the total number counted within target hypothalamic areas.

3. Results

Our results showed that even though light exposure duration was greatly reduced, skeleton photoperiods provide sufficient daylength signals to induce seasonal pelage changes in hamsters. Skeleton short photoperiod induced winter coat in 5 weeks, whereas summer coat was induced within 3 weeks in reverse.

4. Conclusion

Light exposure at specific times of the day can deliver day-length information to trigger seasonal hair color switches.