Leading Scientist Seminar

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@ Room 408, iCeMS Main Building, KUIAS #77

Atypical blue light sensing photoreceptor modulates gut microbiota, social memory and circadian clock in mammals

Abstract

In mammals, the retina at the back of the eye contains three types of photoreceptors. The classic photoreceptors, rod and cone cells, are essential for pattern vision, detecting light through visual opsins and relying on retinal ganglion cells to convey information to the visual cortex. However, a third type of photoreceptor, the intrinsically photosensitive retinal ganglion cells (ipRGCs), project to various nuclei in the hypothalamus and thalamus. These ipRGCs express the photopigment melanopsin, which has a peak absorption spectrum near 478 nm, enabling them to control non-image-forming functions such as circadian photoentrainment and the pupil light reflex. In our study, we discovered that light exposure can reduce social memory formation in mice. Through ipRGCs, light can regulate social memory by activating GABAergic neurons in the peri-supraoptic nucleus (pSON) and inhibiting oxytocin neurons in the supraoptic nucleus (SON). Furthermore, ipRGCs could influence gut microbiota oscillation and hair regeneration through sympathetic nerves, potentially mediated by the suprachiasmatic nucleus (SCN), the central oscillator for the circadian clock. Aberrant light dark cycle such as light exposure at night will impair gut microbe composition and dampen their daily oscillation. In summary, light information in mammals can modulate numerous physiological functions through a direct ipRGC-to-hypothalamus circuit, bypassing the visual cortex. This provides a neural pathway for mammals to respond to external light without "seeing" the light.

Reference

1. Yeh et al., *Nature Communications* 2025
2. Huang et al., *EMBO Reports* 2023
3. Lee et al., *EMBO Reports* 2022

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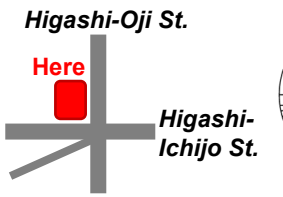

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