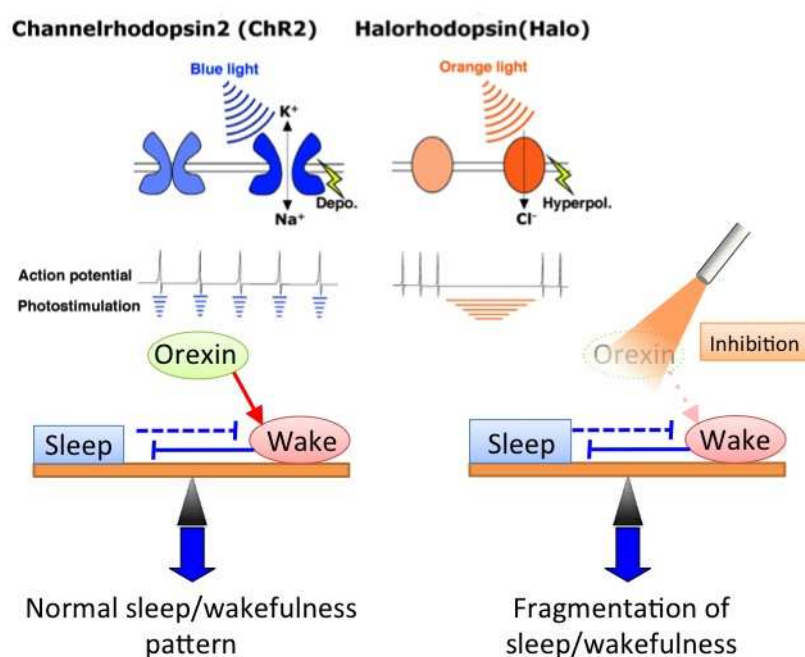


Optogenetical approach to reveal the regulatory mechanism of instinctive behaviors by the hypothalamic neurons

A. Yamanaka^{1,3} and T. Tsunematsu,² ¹Research Institute of Environmental Medicine, Nagoya University, Nagoya, Japan, ²National Institute for Physiological Sciences, Okazaki 444-8787, Japan and ³PRESTO, Japan Science and Technology Agency, Kawaguchi 332-0012, Japan. (Introduced by Andrew Moorhouse)

Instinctive behaviors, such as sleep/wakefulness, feeding and sexual behaviors are regulated by the hypothalamic neurons. Recent research revealed that the hypothalamic neurons containing neuropeptides are implicated in the regulation of these instinctive behaviors. It is essential to study neural regulatory mechanisms of these instinctive behaviors using a whole animal since these instinctive behaviors are exhibited only therein. Optogenetics enable control of the activity of specific type of neurons in the whole body animal using light. We apply optogenetics to Orexin-producing neurons (orexin neurons). Orexin neurons are located in the hypothalamus but project their efferents throughout the brain. Intriguingly, mice lacking the prepro-orexin gene showed behavioral characteristics similar to human sleep disorder “Narcolepsy”, that is a fragmentation of sleep/wakefulness and sudden muscle weakness. Human clinical studies also showed that orexin neurons are specifically ablated in the narcoleptic patient’s brain.



These results suggest that the orexin neurons play a critical role in the regulation of sleep/wakefulness. Previous studies using electrophysiological *in vitro* techniques have identified potential neuronal pathways or networks connecting orexin neurons with other neurons which are known to be involved in sleep/ wakefulness regulation. Our current research involves applying optogenetics in the hypothalamic peptide-containing neurons to reveal regulatory mechanisms of these instinctive behaviors.