MedicalXpress

Cells in eye could help control sleep

August 18 2008

'Our working culture of long hours and shift work, with the 24/7 availability of almost everything, have conspired to demote sleep in our priorities,' says Professor Russell Foster who led the research.

(PhysOrg.com) -- A set of nerve cells in the eye control our levels of sleepiness according to the brightness of our surroundings, Oxford University researchers have discovered. The cells directly regulate the activity of sleep centres in the brain, providing a new target for the development of drugs to control sleep and alertness.

Immune systems, cognitive performance, and mental health are all affected by the body's sleep-wake cycle. Sleep disruption is known to be associated with a range of problems, including depression, immune

impairment and a greater risk of cancer. Many drugs have been developed to modify sleep-wake cycles but these are crude, affecting many chemical pathways and different parts of the brain at the same time, and have side-effects.

'Sleep and the disruption of sleep patterns is a huge problem in the 21st century,' says Professor Russell G. Foster of Oxford's Nuffield Laboratory of Ophthalmology, who led the work. 'Our working culture of long hours and shift work, with the 24/7 availability of almost everything, have conspired to demote sleep in our priorities.'

The presence and absence of light can affect levels of sleepiness and alertness. It's why dimly lit rooms lead us to feel drowsy, while bright lights stimulate wakefulness. During the Second World War it was shown that brightly lit factories had a more alert and productive workforce than dimly lit factories, but until now little was known about how this happened.

'We have discovered a new pathway that modulates sleep and arousal,' Professor Foster explains. 'If we can mimic the effect of light pharmacologically, we could turn sleep on and off.'

Professor Foster and colleagues have previously shown that the eye contains a subset of retinal nerve cells that are sensitive to light. Working on mouse models in which these retinal ganglion cells have been turned off genetically, the research team found that the effects of light on sleep and alertness were completely abolished. The work was supported by the Wellcome Trust and a European Commission grant.

Mice are nocturnal animals, so show the opposite light response to humans. They are alert and active in the dark, but go to sleep in the light.

The Oxford team videoed mice and monitored their muscle and brain

activity for four hours in the dark. The lights were then switched on for an hour and after 15–20 minutes the mice went to sleep. Turning off the light-sensitive retinal ganglion cells abolished this behaviour. The mice stayed awake when the lights were on.

'There was absolutely no effect on the mice. This was a very clear and very surprising result,' comments Professor Foster.

The researchers were able to track this sleep pathway to the brain. They showed that two sleep-inducing centres in the brain are directly activated by the cells, turning on or turning off sleep. By defining the whole light-responsive system that regulates sleep and alertness, the researchers have found a new pathway that could provide a new therapeutic target for manipulation of sleep and arousal in humans.

Provided by Oxford University