MedicalXpress

Snoozing worms help researchers explain the evolution of sleep

January 11 2008

The roundworm C. elegans, a staple of laboratory research, may be key in unlocking one of the central biological mysteries: why we sleep. Researchers at the University of Pennsylvania School of Medicine report in this week's advanced online edition of Nature that the round worm has a sleep-like state, joining most of the animal kingdom in displaying this physiology. This research has implications for explaining the evolution and purpose of sleep and sleep-like states in animals.

In addition, genetic work associated with the study provides new prospects for the use of C. elegans to identify sleep-regulatory genes and drug targets for sleep disorders.

First author David M. Raizen, MD, PhD, Assistant Professor of Neurology, in collaboration with other researchers at the Penn Center for Sleep, showed that there is a period of behavioral quiescence during the worm's development called lethargus that has sleep-like properties. "Just as humans are less responsive during sleep, so is the worm during lethargus," explains Raizen. "And, just as humans fall asleep faster and sleep deeper following sleep deprivation, so does the worm."

By demonstrating that worms sleep, Raizen and colleagues have not only demonstrated the ubiquity of sleep in nature, but also propose a compelling hypothesis for the purpose for sleep.

Because the time of lethargus coincides with a time in the round worms' life cycle when synaptic changes occur in the nervous system, they

propose that sleep is a state required for nervous system plasticity. In other words, in order for the nervous system to grow and change, there must be down time of active behavior. Other researchers at Penn have shown that, in mammals, synaptic changes occur during sleep and that deprivation of sleep results in a disruption of these synaptic changes.

In addition, the research team used C. elegans as a model system to identify a gene that regulates sleep. This gene, which encodes a protein kinase and is regulated by a small molecule called cyclic GMP, has been previously studied but not suspected to play a role in sleep regulation. The findings suggest a potential role for this gene in regulating human sleep and may provide an avenue for developing new drugs for sleep disorders.

“It opens up an entire new line of inquiry into the functions of sleep,” notes Penn Center for Sleep Director and co-author Allan I. Pack, MB, Chb, PhD.

Source: University of Pennsylvania School of Medicine