Researchers reverse the cognitive impairment caused by sleep deprivation

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(PhysOrg.com) -- A research collaboration led by biologists and neuroscientists at the University of Pennsylvania has found a molecular pathway in the brain that is the cause of cognitive impairment due to sleep deprivation. Just as important, the team believes that the cognitive deficits caused by sleep deprivation, such as an inability to focus, learn or memorize, may be reversible by reducing the concentration of a specific enzyme that builds up in the hippocampus of the brain.

It is known that sleep deprivation can have cognitive consequences, including learning and memory deficits, but the mechanisms by which sleep deprivation affects brain function remain unknown. A particular challenge has been to develop approaches to reverse the impact of sleep deprivation on cognitive function.

The findings, reported in this week's issue of the journal *Nature*, could present a new approach to treating the memory and learning deficits of insomnia. A molecular mechanism by which brief sleep deprivation alters hippocampal function is now identified in mice, involving the impairment of cyclic-AMP- and protein-kinase-A-dependent forms of synaptic plasticity, or readiness for cognitive function.

Ted Abel, principal investigator and professor of biology in the School of Arts and Sciences at the University of Pennsylvania, led the international team of researchers that found that sleep deprivation in mice affects an important molecular pathway in the hippocampus, a region of the brain known to be important for memory and learning.

The study showed that mice deprived of sleep had increased levels of the enzyme PDE4 and reduced levels of the molecule cAMP, the latter of which is crucial in forming new synaptic connections in the hippocampus, a physiological hallmark of learning.

Researchers then treated the mice with PDE inhibitors, which rescued the sleep deprivation-induced deficits in cAMP signaling, synaptic plasticity and hippocampus dependent memory. This reversal also helped to rescue deficits in synaptic connections in the hippocampus and therefore counteract some of the memory consequences of sleep deprivation.

"Millions of people regularly obtain insufficient sleep," Abel said. "Our work has identified a treatment in mice that can reverse the cognitive impact of sleep deprivation. Further, our work identifies specific molecular changes in neurons caused by sleep deprivation, and future work on this target protein promises to reveal novel therapeutic approaches to treat the cognitive deficits that accompany sleep disturbances seen in sleep apnea, Alzheimer's disease and schizophrenia."

Source: University of Pennsylvania