Biologists identify genes regulating sleeping and feeding

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In the quest to better understand how the brain chooses between competing behaviors necessary for survival, scientists at the University of Massachusetts Medical School and New York University have isolated two genes in the fruit fly *Drosophila* that work together to mediate the need to sleep and the need to eat. The study, which appears in the online version of *Current Biology*, offers insights that may be used to understand sleep-and metabolism-related disorders in humans.

"This work determines part of the neural mechanism that mediates a conflict in a hungry fly's brain in deciding whether to seek food or sleep ," said Scott Waddell, PhD, associate professor of neurobiology. "It provides a foundation for understanding how the neural control of these two homeostatic behaviors is integrated in the brain."

Previous research has shown that neural systems controlling sleep and feeding in mammals are interconnected: sleep deprivation promotes feeding, whereas starvation suppresses sleep, but little was known about the genes responsible for this interaction. Because the genes that make up *Drosophila*'s internal clock have counterparts with similar functions in mammals, such as those controlling regulation of sleep and metabolism, the study of fruit fly genes can have implications for humans.

After initially screening around 2,000 genes, the researchers identified more than a dozen involved in the interaction between feeding and sleep. From this smaller group, they focused on the Clock and cycle genes, which play a role in both the fruit fly and mammalian circadian, or

biological, clock.

To determine the impact of these two genes on the relationship between sleeping and feeding, the researchers examined fruit flies with and without the Clock and cycle genes under food deprivation conditions—the flies were given only a liquid gel containing no nutrients over a 24-hour period and the researchers monitored the flies' movement to determine resulting sleep behavior.

Their results showed a three-to-four-fold reduction in sleep in starved flies missing the Clock and cycle genes compared to flies possessing these genes. The findings therefore suggest that both Clock and cycle help the flies to regulate sleep when they are food deprived.

"This is a significant advance in how we approach behavioral genetics," said Alex Keene, PhD, a post-doctoral researcher in NYU's department of biology and the study's lead author. "We know that the brain is wired to engage in more than one behavior at a time, but less clear is how the brain chooses between these behaviors. These findings are transformative because they show that a gene can control sleep in a context-specific fashion. In the future, we will need to study animals in different environmental conditions in order to fully understand how the brain controls behavior. "

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