Medical Xpress

# Repressive protein plays unexpected role in odor adaptation

January 14 2009

New research provides valuable insight into the molecular mechanisms that allow experience to influence behavior. The study, published by Cell Press in the January 15th issue of the journal *Neuron*, shows that a normally repressive protein can promote plasticity in sensory neurons by linking odor stimulation with the synthesis of a key adaptation protein.

Successful organisms must be able to adjust their behavior as a result of their experiences. This requires sensory neurons that can accurately sense the environment, paying attention to meaningful stimuli while ignoring persistent stimuli that do not provide critical new information.

"Brief stimulation elicits rapidly reversible adjustments in the excitability of sensory neurons that allow an animal to track changes in its environment while prolonged stimulation elicits more enduring changes that allow the animal to reset its sensitivity to long-lasting alterations, such as the presence of a persistent odor," explains senior study author Dr. Noelle D. L'Etoile from the Center for Neuroscience at the University of California at Davis.

Dr. L'Etoile, along with Dr. Julia Kaye and colleagues, examined how sensory neurons alter their responsiveness as a function of prolonged experiences by studying the molecular mechanisms that underlie adaptation of olfactory sensory neurons in the microscopic worm, *C. elegans*. Specifically, the researchers were interested in determining how an alteration in the synthesis of new proteins (a process called translation) might be involved in sensory neuron plasticity.

Previous research by the group demonstrated that short-term and long-term adaptation of specific *C. elegans* olfactory neurons required the cGMP-dependent protein kinase EGL-4 and that specific mutations within the egl-4 gene interfered with adaptation. Interestingly, the relevant mutations were in an untranslated region of the gene that was shown to be part of a highly conserved translation-repressing Nanos Response Element (NRE).

NREs bind the Pumilio/Fem-3 Binding Factor (PUF) family of translational repressors. The researchers found that both the PUF-binding site within the egl-4 gene and the PUF FBF-1 protein (which binds to the PUF site) were required at the time of odor exposure to promote adaptation to odors. The element also appeared to localize EGL-4 translation near the olfactory neuron sensory cilia.

"Although the RNA-binding PUF proteins have been shown to promote plasticity in development by temporally and spatially repressing translation, this work reveals that in the adult nervous system, they can work in a different way to promote experience-dependent plasticity by activating translation in response to environmental stimulation," explains Dr. L'Etoile.

Source: Cell Press