Scientists discover first moisture-sensing genes

November 7 2007

Researchers in the University of Iowa Roy J. and Lucille A. Carver College of Medicine have discovered the first two genes involved in moisture sensing (hygrosensation). The discovery also reveals a "two-sensor" hygrosensing system in fruit flies that may allow the flies to detect subtle changes in humidity -- an ability that is critical for the flies' survival. The results appear in the Nov. 8 issue of *Nature*.

Subtle variations in humidity influence reproductive behavior and geographic distribution in many animals, including insects, reptiles and birds. Because of their small size, insects, in particular, require a finely tuned ability to detect moisture levels in their environment in order to survive. However, the mechanisms and molecules involved in moisture sensing have remained a mystery.

"Moisture sensing is a sensory modality, which up to this point no one has understood. This is the first study to identify genes that are involved," said Lei Liu, Ph.D., UI postdoctoral fellow in internal medicine and lead author of the study.

Liu and colleagues made their discovery by testing the idea that moisture sensing is a special form of mechanosensation -- the ability to detect physical forces like touch or movement. The researchers used various genetic techniques to study over 20 genes assumed to be involved in touch in fruit flies. Screening each gene mutation for its effect on the flies' ability to detect moisture, the researchers identified two genes that are required for normal moisture sensing. Furthermore, they found that

one of the genes, "nanchung," is involved in detecting dry air, while the other gene, "water witch," is required for detecting moist air.

Both genes are members of the transient receptor potential (TRP) family of genes that code for ion channels. Nanchung, which means "can't hear" in Korean, has previously been shown to be involved in hearing. Water witch has no other known function and was named by Liu and colleagues for its role in sensing moist air. Disruption of either gene impaired the flies' hygrosensing ability.

The researchers also examined where the two genes are expressed in the fruit flies and determined that not only are two separate genes involved in hygrosensation, but also two types of neurons.

"This work provides the first evidence for a sensory system coded by two types of sensory neurons, one responsible for detecting increased moisture and the other responsible for detecting decreased moisture," Liu said.

The researchers speculate that this two-sensor system may allow the flies to detect relative humidity with great sensitivity. Liu added that the "two-sensor" system might also be a model for other sensory processes where the ability to detect subtle environmental changes is important, such as temperature sensing.

The UI findings open the way to a better understanding of hygrosensation, they provide important clues for learning how mechanosensation works, and they may offer new insights into how sensory systems work in living creatures.

Source: University of Iowa