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Master gene Math1 controls framework for perceiving external and internal body parts

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Waking and walking to the bathroom in the pitch black of night requires brain activity that is both conscious and unconscious and requires a single master gene known as Math1 or Atoh1, said Baylor College of Medicine researchers in a report that appears online in the *Proceedings of the National Academy of Sciences*.

Math1 is a master hub for the genes that control various parts of neural networks for hearing, balance, the unconscious sense of one's position in space called proprioception and in a new finding, interoception, which is associated with activities such as awakening because of a full bladder or a distended colon, said Dr. Huda Zoghbi, professor of molecular and human genetics, pediatrics, neurology and neuroscience at BCM and Dr. Matthew Rose, an M.D./Ph.D. student in Zoghbi's laboratory.

"It surprises us," said Zoghbi, who is also director of the Jan and Dan Duncan Neurological Institute at Texas Children's Hospital and a Howard Hughes Medical Institute investigator. "We knew Math1 was important for hearing and proprioception. Now we know this gene lays the foundation for knowing where you are with respect to the environment and how to move safely within it - automatically."

The findings demonstrate a genetic, developmental and functional link among the diverse sensory systems that govern conscious and unconscious proprioception, interoception, hearing, balance and arousal (as from sleep), said Dr. Kaashif Ahmad, a neonatology fellow at BCM and Texas Children's and a member of Zoghbi's laboratory.

Suppose you are walking in the forest and suddenly a predator is heading for you, Zoghbi said. The hearing and sound-localizing activities controlled by this gene allow you to localize the position of the predator and run quickly in the direction away from the predator.

Math1 is a key component of the system that gets you moving automatically in response to internal and external stimuli. In a recent study, the Zoghbi laboratory showed that Math1 also plays a key role in the circuitry of breathing.

"It is possible that some of the neurons that sense movement inside and outside the body are also stimulating the respiratory network of infants when they are born," said Rose.

Studying Math1 is exciting, he said, because many different types of neurons require the gene throughout the brainstem and then connect together in the same sensory networks.

"Math1 is necessary not only for neurons that sense a full bladder but also for those that wake you up and let you find your way to the bathroom in the dark," Rose said. "The key now will be to map out all these connections in greater detail."

Source: Baylor College of Medicine (news : web)