Why can we talk? 'Humanized' mice speak volumes

28 May 2009

Mice carrying a "humanized version" of a gene believed to influence speech and language may not actually talk, but they nonetheless do have a lot to say about our evolutionary past, according to a report in the May 29th issue of the journal *Cell,* a Cell Press publication.

"In the last decade or so, we've come to realize that the mouse is really similar to humans," said Wolfgang Enard of the Max-Planck Institute for Evolutionary Anthropology. "The genes are essentially the same and they also work similarly." Because of that, scientists have learned a tremendous amount about the biology of human diseases by studying mice.

"With this study, we get the first glimpse that mice can be used to study not only disease, but also our own history."

Enard said his team is generally interested in the genomic differences that set humans apart from their primate relatives. One important difference between humans and chimpanzees they have studied are two amino acid substitutions in FOXP2. Those changes became fixed after the human lineage split from chimpanzees and earlier studies have yielded evidence that the gene underwent positive selection. That evolutionary change is thought to reflect selection for some important aspects of speech and language.

"Changes in FOXP2 occurred over the course of human evolution and are the best candidates for genetic changes that might explain why we can speak," Enard said. "The challenge is to study it functionally."

For obvious reasons, the genetic studies needed to sort that out can't be completed in humans or chimpanzees, he said. In the new study, the researchers introduced those substitutions into the FOXP2 gene of mice. They note that the mouse version of the gene is essentially identical to that of chimps, making it a reasonable model for the ancestral human version.

Mice with the human FOXP2 show changes in brain circuits that have previously been linked to human speech, the new research shows. Intriguingly enough, the genetically altered mouse pups also have qualitative differences in ultrasonic vocalizations they use when placed outside the comfort of their mothers' nests. But, Enard says, not enough is known about mouse communication to read too much yet into what exactly those changes might mean.

Although FoxP2 is active in many other tissues of the body, the altered version did not appear to have other effects on the mice, which appeared to be generally healthy.

Those differences offer a window into the evolution of speech and language capacity in the human brain. They said it will now be important to further explore the mechanistic basis of the gene's effects and their possible relationship to characteristics that differ between humans and apes.

"Currently, one can only speculate about the role these effects may have played during human evolution," they wrote. "However, since patients that carry one nonfunctional FOXP2 allele show impairments in the timing and sequencing of orofacial movements, one possibility is that the amino acid substitutions in FOXP2 contributed to an increased fine-tuning of motor control necessary for articulation, i.e., the unique human capacity to learn and coordinate the muscle movements in lungs, larynx, tongue and lips that are necessary for speech. We are confident that concerted studies of mice, humans and other primates will eventually clarify if this is the case."

Source: Cell Press (news : web)