MedicalXpress

Mouse study reveals genetic component of empathy

February 11 2009

The ability to empathize with others is partially determined by genes, according to new research on mice from the University of Wisconsin-Madison and Oregon Health and Science University (OHSU).

In the study, a highly social strain of mice learned to associate a sound played in a specific cage with something negative simply by hearing a mouse in that cage respond with squeaks of distress. A genetically different mouse strain with fewer social tendencies did not learn any connection between the cues and the other mouse's distress, showing that the ability to identify and act on another's emotions may have a genetic basis. The new research will publish Wednesday, Feb. 11, in the *Public Library of Science ONE* journal at http://dx.plos.org/10.1371/journal.pone.0004387.

Like humans, mice can automatically sense and respond to others' positive and negative emotions, such as excitement, fear or anger. Understanding empathy in mice may lead to important discoveries about the social interaction deficits seen in many human psychosocial disorders, including autism, schizophrenia, depression and addiction, the researchers say. For example, nonverbal social cues are frequently used to identify early signs of autism in very young children.

"The core of empathy is being able to have an emotional experience and share that experience with another," says UW-Madison graduate student Jules Panksepp, who led the work along with undergraduate QiLiang Chen. "We are basically trying to deconstruct empathy into smaller

functional units that make it more accessible to biological research."

Animal models of complex social behaviors such as empathy should bring the field closer to understanding what causes social interaction deficits and how they may be treated. "Deficits in empathy are frequently discussed in the context of psychiatric disorders like autism. We think that by coming up with a simplified model of it in a mouse, we're probably getting closer to modeling symptoms of human disorders," Panksepp says.

In the experiments, one mouse observed as another mouse was placed in a test chamber and trained to associate a 30-second tone with a mild foot shock. Upon experiencing the shock, the test mouse emitted a short distress call or squeak.

Though having no direct knowledge of the foot shock, observers from a very social mouse strain learned from the distress calls to associate the test chamber and tone with something negative. When later placed in the test chamber and presented with the tone, they exhibited clear physiological signs of aversion, such as freezing in place, even though no shock was delivered.

In contrast, observer mice from a less gregarious strain — less likely to seek the company of other mice — showed no response to the tone when they were placed in the test chamber.

"The question is, can the mouse identify the emotions of another animal as a predictor of environmental cues?" says Garet Lahvis, a professor of behavioral neuroscience at OHSU. "The social strain learned from the distressed mouse that the tone predicted distress. The nonsocial strain couldn't make that [association]."

The differences exhibited by the two strains show that there is a genetic

component to the ability to perceive and act based on another's emotional state, the researchers say. Future studies will focus on the genetic differences between the mouse strains to try to identify some of the specific genes that may be involved.

While it may come as no surprise to pet owners or those who work with animals that animals are able to pick up on the emotional states of those around them, this type of effect has not been rigorously demonstrated in a scientific context, the researchers say.

"Mice are capable of a more complex form of empathy than we ever believed possible," says Lahvis. "We believe there's a genetic contribution to the ability for empathy that has broad implications for autism research and other psychosocial disorders."

Source: University of Wisconsin-Madison