Scientists discover neurons that 'mirror' the attention of others

18 May 2009

Whether a monkey is looking to the left or merely watching another monkey looking that way, the same neurons in his brain are firing, according to researchers at the Duke University Medical Center.

"We speculate that the neurons' activity may lie beneath critical social behavior, such as joint attention," said Michael Platt, Ph.D., Duke professor of neurobiology and evolutionary anthropology and senior author of the study published in the Proceedings of the National Academy of Sciences. "If social inputs to the neurons are disrupted, that might contribute to the social deficits seen in autism and other disorders."

People spontaneously follow the gaze of other people, and this joint attention helps promote social bonding, enhance learning, and may even be necessary for the development of language. People who can't do these things are at a decided disadvantage, and may fail to develop normal patterns of social interaction, Platt said.

In fact, the impulse to follow the direction of another monkey's eyes was so strong, monkeys sometimes strayed from the assigned light detection task, for which they were rewarded with juice, and instead followed the gaze of a monkey they saw in the projected image.

Previous studies have reported the existence of so-called "mirror" neurons that respond both when monkeys make a particular movement, such as reaching for a peanut, and when the monkeys observe someone else doing the same thing. Given the importance of joint attention and gaze following for both monkeys and humans, many scientists predicted that neurons that mirror observed gaze would be found someday—but until the study by the Duke scientists such nerve cells had never been described.

The attention-mirroring neurons turned out to be located in the parietal lobe, a part of the brain dedicated to eye movements and attention. This is important because it suggests that reading someone else's attention involves the same brain circuits that control one's own attention, Platt said.

In the experiment, the researchers first established whether a particular neuron responded when the monkey himself gazed to the left or to the right. Then they presented the monkey with photos of monkeys randomly looking left or right, thus matching the preferred direction of the neuron on half of trials.

Images of monkey faces randomly lit up for 100 to 800 milliseconds (about the time it takes a fastball to leave the pitcher's hand and cross home plate) and then a yellow box appeared randomly either on the left or right.

Monkeys had to shift their gaze from the center to the box as quickly as possible and maintain fixation for at least 300 ms to receive a juice reward. Typically, monkeys were faster to shift gaze to the box when they had previously seen a picture of a monkey looking in that direction—presumably because their own attention had shifted in the same direction.

The researchers learned that the time period in which they saw the response by the neuron was also the time period in which they saw the biggest behavioral effect. "If the monkey saw another monkey for 100 or 200 milliseconds looking in a certain direction, that's when he is most likely to follow the gaze of that monkey or share the monkey's attention," said Platt.

Despite widespread speculation about mirror neurons in humans and what they might do, the only studies on mirror neurons to date have been performed in monkeys, Platt said.

"We argue that there is a system in place that is devoted to taking in important social information and using it to guide one's behavior," Platt said. "It is a very simple type of imitative behavior that these neurons seem to be driving. They act like mirror neurons, but for attention, not for an overt action."

Source: Duke University Medical Center (news : web)