Distinguishing yourself from others

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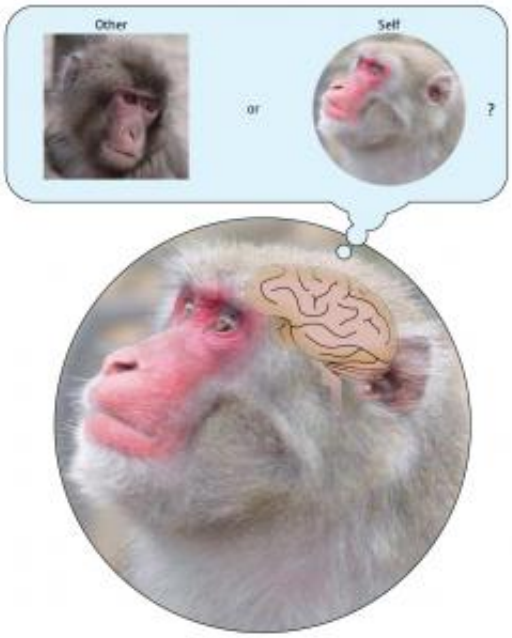

Figure 1: Groups of neurons in a specific part of the brain called the medial frontal cortex, which is associated with social learning, fire in ways that help individuals to distinguish between self and others. Credit: 2011 Masaki Isoda

(Medical Xpress) -- Researchers in Japan have identified the specific nerve cells responsible for the ability to distinguish between the actions of self and others. The discovery lays the foundations for studying social learning at the level of nerve cells using a new experimental technique. The work, led by Masaki Isoda from the Okinawa Institute of Science and Technology and Atsushi Iriki from the RIKEN Brain Science Institute, may lead to a better understanding of mental conditions where distinctions between self and others become confused.

Neuroscientists have long known that nerve cells called 'mirror neurons'-found mainly in the brain's cerebral cortex-fire when an individual performs an action or observes one performed by somebody else. The resulting information can be used as a basis for understanding others and for social interaction but, until now, a critical part of the puzzle was missing. If the same group of neurons fired when performing or observing an action, how could an individual distinguish self from other?

"Obviously, the brain needs a separate mechanism that enables one to make that distinction," says Isoda. The researchers recognized that to find that mechanism they needed to develop an interactive task involving both observation and action that could be used to measure associated differences in the activity of neurons.

The task they designed involved two monkeys sitting face to face and taking turns to make choices of pushing one of two different colored buttons for a reward. Both monkeys were rewarded for a right choice and neither received a reward for a wrong choice. Each monkey had two turns, and then control would pass to the other. For blocks of between 5 and 17 turns, the color associated with the reward remained the same, but then it would change. So, observing which color was rewarded was important to success.

The researchers found the monkeys were quite capable of observing and learning from another's action in planning their own response. Then, by monitoring the activity of 862 neurons in the medial frontal cortex (MFC) of the brain-which is associated with social cognition-they detected groups of neurons that were selectively activated only when a monkey's partner performed the action. The researchers observed these 'partner-fired' neurons in dominant and submissive monkeys , and found they were most prevalent in the dorsomedial convexity region of the MFC (Fig. 1).

"In future, we hope to be able to identify the entire neuronal network and precise neuronal operation involved in self/other distinction," Isoda says.

More information: Yoshida, K., et al. Representation of others' action by neurons in monkey medial frontal cortex. *Current Biology* 21,

249 - 253 (2011). www.cell.com/current-biology/a …
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