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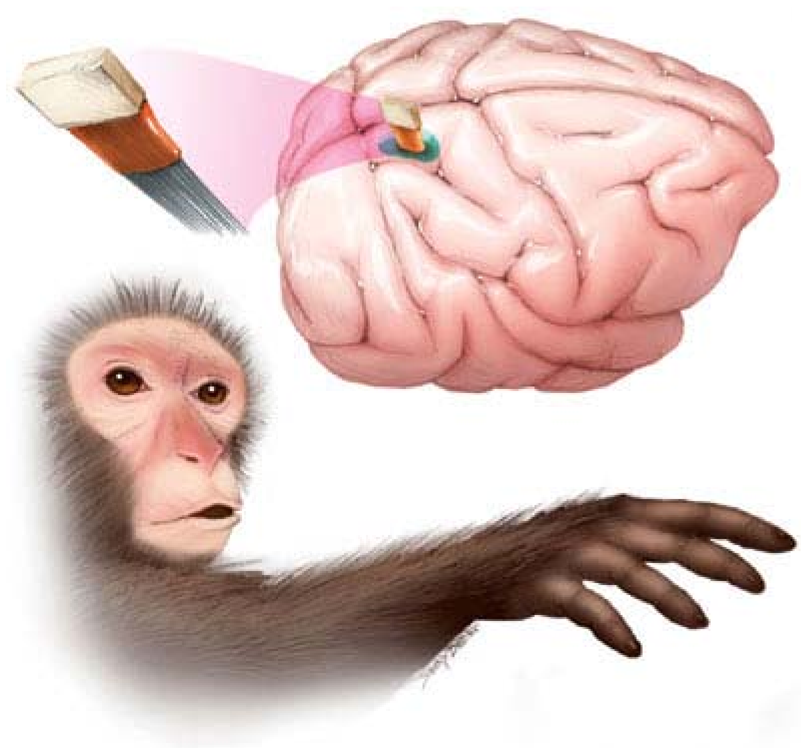
Monkey See, Monkey Think About Doing

For years, researchers have dreamed of devising prosthetic devices that paralyzed people could operate by brain signals alone. Many of their efforts have focused on using electrical activity in brain regions that coordinate the details of body movement to guide robot arms or move a computer cursor. Now researchers report data that suggest another potentially useful approach: tapping into the messages of higher-order neurons involved in planning and motivation.



Monitoring intent. Electrodes implanted in the parietal reach region tap into neurons that determine the direction in which a monkey is planning to reach.

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The higher-order neurons in question hail from the so-called parietal reach region (PRR). In the mid-1990s, neurophysiologist Richard Andersen of the California Institute of Technology in Pasadena and his colleagues discovered that this patch of brain tissue just above the ears is important in planning--but not executing--actions such as arm movements. Soon after, Andersen began to wonder whether signals from these cells might be useful in prosthetics.

Several years ago, Andersen and colleagues implanted arrays of 96 electrodes into the PRR and a neighboring brain area of three monkeys. While the monkeys were waiting for a cue that told them to reach toward an icon that had just flashed on a screen in one of up to eight locations, a computer program tried to interpret the patterns of neuronal activity recorded by the electrodes. Once the neuronal "reaching" code was broken, the program began using it to determine the direction the monkeys were planning to reach during trials in which a monkey thought about reaching but did not actually do so (because they were not rewarded if they reached).

Initially, the program had trouble matching the monkeys' intentions to the icon's position. But as the monkeys practiced thinking about reaching, they honed the signals sent by the PRR cells, so that the computer decoded the correct direction--and the monkeys were rewarded--

more frequently. After 2 months, the computer accurately forecast the intended direction of the incipient reach as much as 67% of the time when there were eight potential positions for the icon, versus 12.5% by chance, the team reports in the 9 July issue of *Science*. These are the goal signals, explains Andersen: "They indicate the thought, 'I want to pick up that glass.'"

Tapping cognitive brain areas to understand a paralyzed patient's goals and decisions could be of significant value, other researchers say. Signals from such areas may become an important tool for neural prosthetics, says Philip Kennedy, a neuroscientist and founder of Atlanta-based Neural Signals Inc. "Just a few good higher-order neurons can issue smart commands to control a variety of machines and robots," he predicts.

--INGRID WICKELGREN

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