

NEUROSCIENCE

Monkey See, Monkey Think About Doing

For years, researchers have dreamed of devising prosthetic devices that paralyzed people could operate by brain signals alone. So far, patients' brain waves (electroencephalogram recordings) have controlled simple computer programs, and robots and cursors have moved under the guidance of brain cells that dictate motion (*Science*, 24 January 2003, p. 496). Until now, however, nobody has succeeded in tapping the messages of higher-order neurons involved in planning and motivation for potential use in prosthetics.

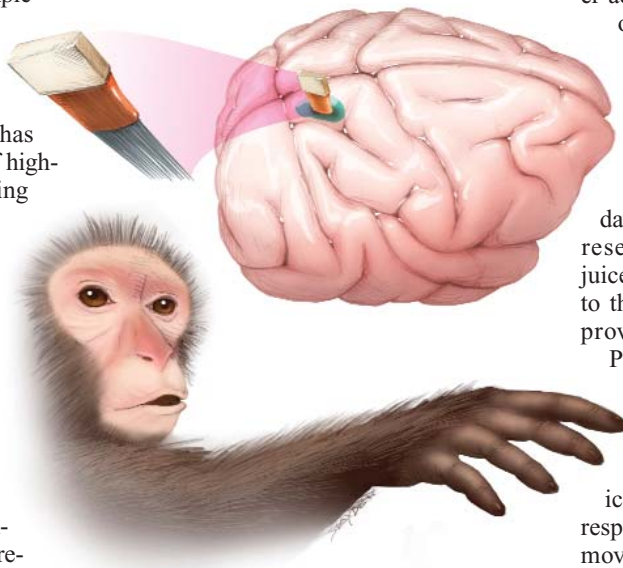
On page 258, neurophysiologists Richard Andersen and Sam Musallam of the California Institute of Technology in Pasadena and their colleagues report eavesdropping on neurons in a cognitive brain area involved in planning—but not executing—future arm movements. They used a computer to read the monkey's mind and predict its intentions the majority of the time. The researchers also gleaned information from these neurons about how badly the monkey wanted to perform the task to get its promised reward. "We can read out a large number of variables related to the monkey's thoughts," Andersen says.

The work, says Dawn Taylor, a biomedical engineer at Case Western Reserve University and the Cleveland VA Medical Center in Ohio, is a big step toward using goal-oriented signals in prosthetic devices. Such signals, adds Philip Kennedy, a neuroscientist and founder of Atlanta-based Neural Signals Inc., may become an important tool for neural prosthetics: "Just a few good higher-order neurons can issue smart commands to control a variety of machines and robots," he predicts.

The higher-order neurons in question hail from the so-called parietal reach region (PRR). In the mid-1990s, Andersen and his colleagues discovered that this patch of brain tissue just above the ears is important in planning actions. Soon after, Andersen began to wonder whether signals from these cells might be useful in prosthetics.

Several years ago, Andersen, Musallam, and their 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 inter-

pret 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



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

monkeys were planning to reach during trials in which a monkey thought about reaching but did not actually do so (because it was not rewarded if it reached), to mimic

SCIENTIFIC MEETINGS

Neuroscientists Learn Lesson in Diplomacy

About a dozen National Institutes of Health (NIH) scientists almost missed a major international meeting in Hungary last month because of continuing efforts by the Bush Administration to curb foreign travel. A last-minute "exception" by NIH's parent agency allowed all but three scientists to participate.

The 10th meeting of the Organization for Human Brain Mapping, held 13 to 17 June in Budapest, is a major event for neuroscientists. But NIH officials had accidentally left it off a list of international meetings submitted each year to the Office of Global Health Affairs at the Department of Health and Human Services (HHS). Two weeks before the meeting, says HHS spokesperson William Pierce, "all of a sudden we got this notice" that 57 scientists from NIH were heading off to Budapest. That "violated policy," he says. "You can't just show up as a government official someplace."

what would happen with a paralyzed person.

Initially, the program had trouble matching the monkeys' intentions to the icon's position much more often than chance would predict. But as the monkeys practiced thinking about reaching over and over again, 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. These are the goal signals, explains Andersen: "They indicate the thought, 'I want to pick up that glass.'"

After hundreds of trials in a single day, the monkeys would get bored, so the researchers motivated them with more juice or a new type of juice, a change that, to the scientists' surprise, appeared to improve the signals of the neurons in the PRR even further. When Musallam and Andersen tested the relation by alerting the monkeys to an imminent improvement in the reward by enlarging or shrinking the size of the icon, the cells in the PRR became more responsive to the direction of the planned movement, and the computer's ability to predict direction improved by as much as 21%. Moreover, the researchers found that they could predict from the neurons whether the monkeys expected the better or worse reward 80% to 90% of the time, suggesting for the first time that this brain region also governs motivation to reach for something, Andersen says. ▶

HHS initially said only 43 people could go, forcing NIH to tell the rest—some on their way to the airport—to stay home. Global affairs officials later reconsidered and agreed to allow all 57 to attend, although three people didn't get the message in time to make their flights, an NIH official says.

The HHS policy has been in effect for several years, says Pierce, because attendees represent the U.S. government and their trips must be cleared with the host country. Moreover, last summer HHS set a roughly 40-person limit on international meetings in an attempt to save money. That is why only 60 HHS staffers (down from 236 two years ago) will attend the XV International AIDS Conference this month in Bangkok, Thailand, Pierce says—not because HHS Secretary Tommy Thompson was heckled last time, as has been widely reported (*Science*, 23 April, p. 499).

—JOCELYN KAISER

ILLUSTRATION: CAMERON SLANDEN/SCIENCE

Spain Produces New Stem Cell Lines

BARCELONA—Spanish researchers announced last week that they had created the country's first cell lines from human embryonic stem (ES) cells. VAL-1 and VAL-2 join a club of six human ES cell lines worldwide that have been cultivated in a human-derived medium.

The health ministry said it would investigate whether the research, led by Carlos Simón of the Regenerative Medicine Center in Valencia, had received government permission. The announcement comes in the midst of plans by health minister Elena Salgado to relax restrictions on research on human embryos as part of changes to a 1-year-old law on assisted reproduction.

Simón says the new cell lines will be stored at the U.K. Stem Cell Bank—one of Europe's two public repositories for stem cells—and made available to researchers worldwide.

—XAVIER BOSCH

Bell Labs to Open Irish Research Center

Bell Labs, the research arm of Lucent Technologies, is setting up an Irish lab to focus on network architecture, wireless communications, and photonics research.

The center, based at Lucent's existing facility at Blanchardstown, outside Dublin, will be the company's second overseas research facility. (A Beijing center opened in 1999.) Its 40-person staff will include expats from headquarters in Murray Hill, New Jersey, and local hires. Some 90 researchers at nine Irish universities and colleges will collaborate with the new lab, which opens in September.

—DANIEL CLERY

Try, Try Again

TOKYO—Japan's space scientists are hoping that an upcoming Russian mission will give them a second chance to study Mars.

Instruments to monitor Mars's magnetic field, atmospheric dust, the solar wind, and other characteristics were on board the Nozomi satellite that failed to enter Mars orbit last December. But a 2009 Russian mission to Phobos, one of the Red Planet's moons, may provide Japan with another opportunity—if officials can get a down payment in their 2005 space budget toward what may eventually total \$25 million to \$40 million for Japan's contribution to the project.

The Russian mission hopes to collect and return soil samples from Phobos, while the Japanese spacecraft would circle the planet. Two previous Soviet attempts to visit Phobos failed in the late 1980s.

—DENNIS NORMILE

Tapping cognitive brain areas to understand a paralyzed patient's goals and decisions could be of significant value, researchers agree, especially if other brain areas are damaged. In some cases, these signals might be used in combination with those from brain areas coordinating the de-

tails of movement. "At certain points in the process, a goal-oriented response would be very useful," says Taylor. "For many applications, though, we also need other command signals that fine-tune the movement to make [the device] practical."

—INGRID WICKELGREN

SARS

China Dumps CDC Head, Probes Lab

JINAN, CHINA—Severe acute respiratory syndrome (SARS) has toppled another top Chinese official. Last week Li Liming, the director of China's Center for Disease Control and Prevention (CDC), resigned along with a deputy director after a report by an expert panel blamed a SARS outbreak this spring on a series of flaws at CDC's National Institute of Virology in Beijing. Three other CDC officials have been disciplined. The government immediately named 47-year-old Wang Yu as CDC director.

The outbreak, which sickened eight people in Beijing and Anhui Province and killed one, started when two CDC workers developed SARS. The most likely source of the infection, the report concludes, is a

el. Antibody tests revealed that, apart from the two known SARS cases, two other people, including Ren, were infected with the virus. They apparently developed a mild, SARS-like illness as early as February that wasn't picked up at the time, says Roy Wadia, a spokesperson at the World Health Organization (WHO) in Beijing.

The summary report mentions further "flaws" in adherence to regulations, but without giving specifics. One obvious mistake, says Xu Jun, deputy director of the Guangzhou Institute of Respiratory Diseases, is that the lab didn't properly monitor its workers' health status.

Some scientists see the report and shake-up at CDC as positive steps. "This is a clear

sign to Chinese scientists and the rest of the world that the Chinese government is taking [biosafety] seriously," says Guan Yi, a virologist at the University of Hong Kong. But others are disappointed that details of the incident and the lab's operating procedures remain hidden. "I was hoping for a full, more open account of what happened," says Anthony Della-Porta, an Australian biosafety consultant.

Wang has been deputy director of rural and social development within the Chinese Ministry of Science and Technology. A physician and researcher, he has held a number of administrative positions and represents a "new generation" of more open Chinese leaders, says virologist David Ho of the Aaron Diamond AIDS Research Center in New York City, who recently met him.

Guan says that Wang will need a bigger budget to reform CDC and update the agency's antiquated facilities: "I hope the Chinese government gives him enough support to put the CDC on the right track."

—MARTIN ENSERINK AND LEI DU

With reporting by Dennis Normile. Lei Du is a freelance writer in Jinan, Shandong Province.



Change at top. China's Wang Yu (left) replaces Li Liming at CDC.

batch of supposedly inactivated SARS virus that was brought from a biosafety level 3 lab into a low-safety diarrheal research lab where the two were working. The inactivation process—adding a mix of detergents to the virus—apparently did not work properly, according to the study, a five-paragraph summary of which was released by the Ministry of Health on 1 July. Last year the health minister and mayor of Beijing were sacked for their role in covering up the initial SARS outbreak.

In a breach of standard safety procedures, the researcher who carried out the inactivation—identified only as "Ren"—had not tested whether the virus was truly inactive, according to the seven-member pan-

CREDITS: (LEFT TO RIGHT) SONG JIHE/CNSPHOTO; ZHANG WEI/CNSPHOTO