Mind-Machine Merger

Devices that connect the brain with computers could lead to mind-controlled robots, repair neurological disorders, and even improve memory.

By Gregory T. Huang
May 2003

Ted Berger is a mind reader. The minds of rats, that is. In his lab at the University of Southern California, the neurobiologist places a tiny array of electrodes onto a slice of a rat's brain in a petri dish. With the flip of a switch, graduate student Walid Soussou starts the flow of electrical signals into the tissue. The brain cells respond by generating their own electrical impulses. This swirling pattern of neural signals is picked up by the electrodes and appears on a nearby computer screen as a wash of colors ranging from brilliant red to dark blue.

For the next few hours, Berger and his team will map out the circuitry behind one of the brain's most complex functions: memory. It's basic research, but they are doing it with a big technological goal in mind. Berger's group aims to use the information to build an advanced "brain-machine interface"—a device that links the biological circuits of a brain to the silicon circuits of a computer—that will change how the mind thinks.

In recent years, research groups around the country have implanted electrodes in the brains of animals—and even a few humans—and have used signals detected by those electrodes to move robot arms, levers, and cursors on computer screens (see "Other Brain-Machine Research," table, last page). The aim of the work has been to give paralyzed patients the ability to control...
prosthetic limbs and simple communication tools. But Berger’s objective is even more far-reaching: to build a computer chip that will restore the cognitive abilities of the brain itself, aiding memory in patients who suffer from such neurological disorders as Alzheimer’s disease and stroke and perhaps eventually enhancing the abilities of healthy minds. To do so, the researchers have to understand neural processes that may be more complicated than those that govern, say, the control of a prosthetic arm. “It’s one of the most ambitious projects in the whole field,” says Christof Koch, an expert on computation and neural systems at Caltech.

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