types of FES are under investigation for help in bowel and bladder control, coughing, walking, and standing. However, relatively little attention has been paid the subtle muscle movements of torso stabilization required for balanced, steady sitting, says **Ari Wilkenfeld**, **MD**, **PhD**, first author of the study that appeared in the March/April issue of the *Journal of Rehabilitation Research & Development*.

A stable seated position means being able to reach with one or both hands and not fall over, Wilkenfeld says. A healthy posture also prevents skeletal deformities, pressure wounds, and too much pressure on internal organs.

The Cleveland group's model of the human torso simulates how three muscle groups work in synergy to rotate the spine and bend it forward and sideways. Knowing from previous research that a paralyzed muscle stimulated by FES produces, at most, about 50 percent of the force of a non-paralyzed muscle, Wilkenfeld, along with investigators **Ronald Triolo**, **PhD**, and **Musa Audu**, **PhD**, at the Cleveland FES Center, used the model to calculate the largest range of stable movement that a paralyzed torso could attain under ideal FES.

They found that with the help of FES, paralyzed individuals can hold the weight of one or two bricks at arm's length, bend forward enough to extend their reach by almost a foot, and bend to the side a bit more.

In addition to creating the model, the Cleveland researchers compared its predictions to the actual sitting of a test volunteer with one pair of implanted spine electrodes. They found that one pair is not ideal because it does not fully activate even one of the sets of muscles. Yet they found that the model describes seated postures well.

"It is a promising start," says **Jason Gillette**, **PhD**, an assistant professor who specializes in biomechanics and motor control at Iowa State University. He suggests testing more individuals and expanding the tests to include active reaching, not just still postures.

Additionally, says Wilkenfeld, they'll need a more sophisticated system of FES implanted electrodes to get the kind of results predicted by the model. Yet, now that they have a model that shows two-handed reach and the stable sitting postures theoretically possible, they can work on the practical details for attaining them.
—Louisa Dalton

Brain Chips

Neurons are tough cells to study. There are a staggering number of them in most animals, and they are constantly talking with one another. One way to look at groups of neurons in real-time is to take a slice of brain, stimulate it electrically, and measure responses across the slice. Now a new tool may give researchers more neuronal data in the span of a few milliseconds than ever before.

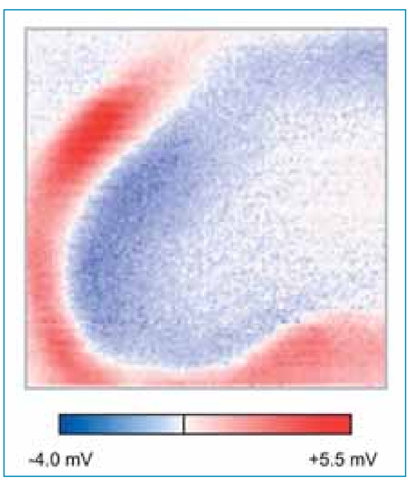
A team headed by **Peter Fromherz**, **PhD**, a director at Max Planck Institute for Biochemistry in Munich, has developed a computer chip that can measure the activity of thousands of neurons at a time. "We can get a movie of a complete electroactivity map in space and time, with a resolution of eight micrometers," Fromherz says. The work was published in the September 2006 issue of the *Journal of Neurophysiology*.

Fromherz's group worked with Infineon Technologies in Munich to create a special 1-square-millimeter silicon chip containing more than 16,000 transistors. To prepare the device for data collection, the researchers first culture a thin slice of rat hippocampus onto the chip for a few days. Then they stimulate the slice with microelectrodes and take an electrical snapshot every half-millisecond. "Transistors in the chip measure the voltages that arise in the slice, so we can see how electrical activity propagates in the tissue," Fromherz says.

Although the chips themselves are relatively simple, Fromherz says, the computer technology behind it is rather complicated. His team is retooling the apparatus so that it can run off a PC rather than the specialized computers used now. After that, they'll work to make the entire system commercially available for other scientists.

Fromherz's long-term goal is neurocomputing, a coupling of both brain and silicon. He hopes that semiconductor technology can eventually benefit from the brain's powerful ability to store memories. "Right now, that is a little bit science fictiony, I know," Fromherz says. But Fromherz has less lofty goals for the near future. He'd like to see the brain chip help pharmaceutical researchers expand their study of drug effects on the brain by providing data on thousands of neurons at a time. And he hopes that the technology will prove useful to neuroscientists who are open to new technology. "Now the neuroscientists have a new tool, and they will need to think about completely new questions," Fromzherz says.

Indeed, it remains to be seen how useful this chip will turn out to be for brain researchers, says **Arthur Toga**, **PhD**, professor of neurology at the University of California, Los Angeles. "But I'm a firm believer that almost every leap forward in neuroscience has been preceded by a technological innovation, one that allows us to pose questions that couldn't be posed before," he says. "That's been true all the way from the microscope to the MRI."
—Regina Nuzzo, PhD □



Fromherz and his colleagues used more than 16,000 transistors on a 1-square-millimeter silicon chip to measure field potentials from a slice of rat brain every half-millisecond after stimulation with electrodes. This image shows those potentials after 5 milliseconds have elapsed. Red regions indicate positive voltage; negative signals are in blue. The gray curve traces the structure of the **cornu ammonis** ***in the hippocampus.***