A Call to Action on a Human Brain Project

The Institute of Medicine endorses a plan for computerized maps of the brain but ducks questions of strategy and cost.

PHYSICISTS HAVE THE SUPERCONDUCTING Super Collider. Geneticists have the Human Genome Project. And now, if an Institute of Medicine (IOM) committee has its way, neuroscientists will soon have a Brain Mapping Initiative. In a report released this week, the committee enthusiastically endorses an ambitious, two-decade effort to develop a set of sophisticated computer databases and three-dimensional models of the brain.*

But while lobbying hard for the new brain project, committee members are hazy about how it might be carried out—and they carefully sidestep any mention of what it might cost beyond acknowledging that it will be expensive. Estimates by outsiders range from tens of millions to several billion dollars.

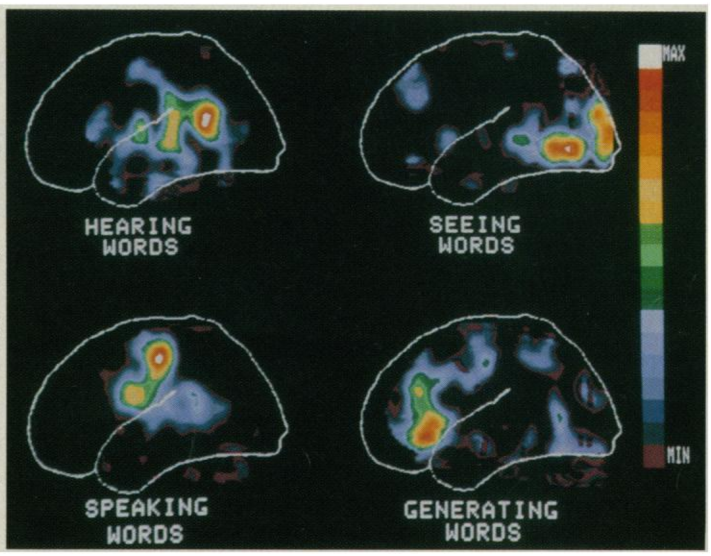
Committee members do concede that selling another "big" science project, whatever its final tab, amidst all the worries about declining grants may be a tall order. Indeed, while the idea already has the support of the agencies that sponsored the study—the National Institute of Mental Health, the National Institute on Drug Abuse, and the National Science Foundation (NSF)—it apparently does not have the backing of the National Institute of Neurological Disorders and Stroke, a major funder of neuroscience research. In addition, the support of the neuroscience community is far from assured. Notes committee member Richard Lucier, university librarian at the University of California, San Francisco: "I don't think there is a consensus. A lot of people don't use the [computer] technology and don't see the value of it. And there is a lot of strong feeling about taking money away from [investigator-initiated] grants."

Nonetheless, the committee seems undaunted, insisting that the new effort is essential if we are to understand the human brain, much less cure the myriad neurological disorders that plague tens of millions of Americans. The brain is so complex and "the data are so massive in amount that it is very difficult to come to grips with it all," says committee member Marcus Raichle of Washington University School of Medicine. Joseph Martin, dean of the school of medicine at UC San Francisco, who chaired the committee, agrees. "We have got to do it."

The map itself can be thought of as a Landsat image, says Constance Pechura, the staff director of the IOM study, in which information about, say, roads or annual rainfall can be added to a baseline image of the earth's surface. In this case, the baseline would be the anatomy of the brain. "What we hope to be able to do is to take a basic picture of a brain section and layer onto that the location of neurotransmitter receptors, or areas that bind drugs, or areas that are disrupted in certain diseases," she explains.

The information would be stored in a complex of linked databases that individual investigators could log into from their desk-top computers. After calling up a particular "slice" of the brain, an investigator could, for example, zoom in to the molecular level for information on receptors, then back out to look at the connections to other regions of the brain.

Department of Neurology, Washington University School of Medicine



Word processing. *PET images showing changes in blood flow—hence in brain activity—in different types of information processing.*

Whether mappers can actually pull off these ambitious plans is far from certain. "It will be incredibly difficult," says Peter Pearson, who directs the new Genome Data Base at Johns Hopkins University. "Genome project informatics is trivial by comparison." The committee concedes as much, noting that it will depend on "significant advances" in databases, networks, imaging, and other technologies.

What's more, the success of the project will require not just technological pyrotechnics but also changes in the way neuroscientists work, both Pearson and the committee note. Investigators will have to share their data before publication, but, as the committee points out, the tradition of data sharing is not well established in the neuroscience community. In that regard, concedes Martin, "the neuroscience community is 5 years behind the genome community."

Faced with these daunting problems, the committee recommends starting fairly small, with a handful of pilot projects funded at a total of $10 million a year over 5 years. Mappers should gain enough experience from these pilot studies to then begin designing and building the computer maps and models—a process that could take 15 to 20 years.

To coordinate the effort, the group recommends setting up an advisory panel of neuroscientists and computer scientists. That leaves unanswered, however, what teeth this panel would have, where it would be situated, and how it would be funded. And if the Human Genome Project is any guide, the initiative won't get off the ground without a strong leader. Says Roger Porter, deputy director of the Neurology Institute: "They have to have a champion at the top who believes it is worth doing. I'm not sure that will happen."

Porter has other reservations as well. Indeed, IOM staff said that he and other institute officials were so skeptical that they decided against even supporting the IOM study. "There is no question, current brain mapping efforts are fragmented and we need to think about a coordinated project," says Porter. "But I don't think we are ready for it yet." Not only are the technical problems daunting but the brain mapping community has not really figured out what they would use the database for. "If we start building a database but don't have a very clear endpoint, we run the risk of wasting money."

But chairman Martin predicts the initiative will have no shortage of backers, as both NSF and several National Institutes of Health institutes are likely to begin supporting pilot studies. He is convinced that the brain map will indeed be built—"the only question is how fast." ■ LESLIE ROBERTS

* *Mapping the Brain and its Functions,* National Academy Press, 1991.