

Expert discusses how BRAIN Initiative will affect neuroscience

April 24 2013, by Rob Matheson

Mapping the human brain, with its billions of neurons, is one of science's most elusive projects. But a new federal program—the \$100 million [Brain Research through Advancing Innovative Neurotechnologies \(BRAIN\) Initiative](#)—could help neuroscientists at MIT and other institutions unlock some of the brain's mysteries.

How will MIT contribute to the initiative's goals? How will the initiative impact research already being done at MIT and in the Boston area? How will science benefit? Robert Desimone, the Doris and Don Berkey Professor of Neuroscience and director of MIT's McGovern Institute for [Brain Research](#)—and one of four MIT researchers selected to attend the initiative's White House announcement on April 2—discussed these questions with MIT News.

Q. What types of new technologies will be developed to achieve the goals of the initiative? And what are the benefits of the initiative, in terms of better understanding the human brain and treatment of neurological disorders?

A. Among the technologies being discussed are large arrays of nanoscale electrodes; [robotic devices](#) for massively parallel whole-cell recordings; new optical methods for imaging activity deep within the brain; and tools from [molecular genetics](#) that would allow neurons to store records of

their own activity and which we could read out at a later time. We also need better ways to assess biological measures beyond [electrical activity](#)—[gene expression](#), for example.

Much of this work will be done in animal models, but we must also develop noninvasive methods so we can relate what we learn from animals to what can be measured in human subjects. And finally, we will also need new [analytical methods](#), including a lot of [computing power](#), if we are to make sense of all these new data and to understand how 100 billion neurons can work together as a system.

When [neurons](#) interact with each other in large numbers, new phenomena emerge—much as new [social phenomena](#) emerge when large numbers of people interact in groups. Understanding these large-scale interactions will be important if we are to understand the basis of both normal behavior and the altered behaviors seen in many brain disorders. There is evidence that both autism and schizophrenia, for example, involve abnormal synchronous activity across widespread neural populations.

Q. What will MIT's role be in the initiative? How will MIT collaborate with other Boston-area institutions (and institutions around the nation) to achieve the initiative's goals?

A. MIT is well-positioned to contribute to the BRAIN Initiative, as many of our researchers are already leaders in developing new technologies for neuroscience. One example is optogenetics, a method for controlling brain activity with light that is already revolutionizing the field.

At the McGovern Institute, we have established a neurotechnology program that provides seed funding for neuroscientists to work with

engineers, computer scientists, materials scientists and so on, both within and beyond MIT. We've already supported more than 20 such projects, some of which have now turned into major research programs.

We're very fortunate to have so many top research and clinical institutions in Boston, and we have strong collaborations with many of them. The Martinos Center at the McGovern Institute, where we do human neuroimaging, shares strong ties with its sister center at Massachusetts General Hospital, and also has collaborations with many other local hospitals and universities. Some of us are also members of a Boston-wide initiative to understand the activity of large neural populations, funded by a grant from the National Science Foundation. We also have faculty affiliated with the Broad Institute, and with the Stanley Center for Psychiatric Research, which is tremendously helpful for our work on psychiatric disease.

Q. How will the initiative affect the research already being done at MIT and other facilities in the Boston area, including MIT's neighbors in Kendall Square?

A. MIT labs will apply for funding through the BRAIN Initiative as soon as the funding mechanisms are established. Many of us hope that President Obama's support will encourage private foundations and individuals to contribute.

MIT has a strong track record of working with industry, and we will certainly need to do that if our discoveries are to lead to new therapies. Kendall Square has a great concentration of biotech and high-tech companies, and several large pharmaceutical companies also have a strong presence here. I see them as natural collaborators on the BRAIN Initiative, especially given the huge unmet need for new treatments for brain disease.

Beyond new therapies, I believe the new technologies developed through [BRAIN](#) will lead to many other spinoff products, from new optical devices to intelligent machines. The president said it well: Scientific research has had a great return on investment.

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