Next steps in understanding brain function

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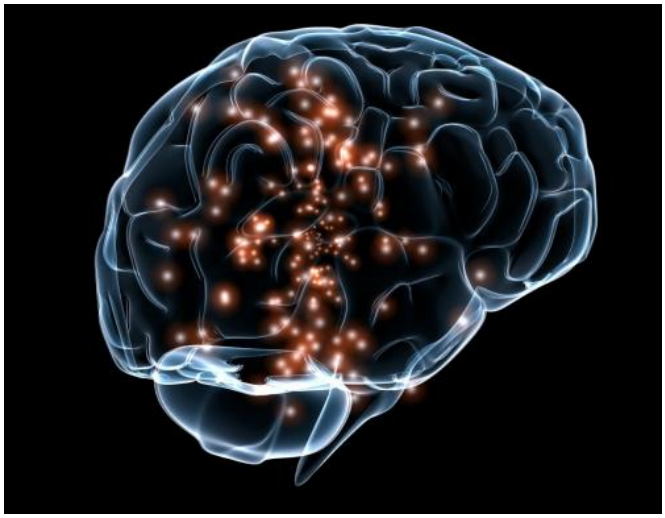

Credit: Wikimedia Commons

The most complex piece of matter in the known universe is the brain. Neuroscientists have recently taken on the challenge to understand brain function from its intricate anatomy and structure. There is no sure way to go about it, and Dr. Javier DeFelipe at the Cajal Institute in Madrid proposed a solution, in his *Frontiers in Neuroanatomy* Grand Challenge article "The anatomical problem posed by brain complexity and size: a potential solution."

Today, one year after the Challenge was published, DeFelipe and colleagues published a discussion around the actual size of the problem and possible solutions, in the new article "Comments and general discussion on 'The anatomical problem posed by brain complexity and size: a potential solution'."

"Rather than attempting to fully reconstruct the whole brain or a particular brain region, the solution seems to lie in realistic computational modelling of the brain," says DeFelipe. This approach has inspired scientists all over the globe to contribute to large multidisciplinary projects, known as big data projects. The challenge is grand because it goes straight into and beyond the matter of Is there one best way to study brain function?

Designing an approach that tackles brain complexity has challenged scientists to rethink some of the most fundamental aspects of their work and to innovate. "Realist brain models based on biological data obtained in the lab can speed our understanding of brain function, because we expect it to require much less than timely experiments in living tissue," says DeFelipe, "But as a neuroanatomist, I believe—as do many of my colleagues—that there is a lot of confusion about the anatomy of the brain and that there are frequent misunderstandings and wrong assumptions about many aspects of the brain organization or the use of experimental animals," he explains.

By uniting many contributors in the discussion, the article resulted in a constructive and thoughtful dialogue from different views on the study of the human brain. "My idea was to present this problem to other neuroscientists and general readers in a simple manner and, try to provide a solution," he says.

The study of the human brain is challenging, not only because of its complexity and technical difficulties, but also because of ethical limitations. "For obvious reasons, we are not always ethically allowed to collect all the necessary types of data directly from human brains. So, there is a big debate about the range of specific strategies that we should use." The discussion also touches whether big worldwide projects, like the Human Brain Project based in Europe and the Brain Activity Map based in the United States, are a new and better paradigm to go forward, he says, or "if it is better to just follow the most common and traditional scheme of supporting relatively small groups of researchers."

This discussion comes at an important moment for neuroscience, with potential impact on the hundred millions of funding devoted to the development of extraordinary technology inspired by biology. "The

results of such large efforts can be a true paradigm shift", says DeFelipe, whose main focus is the study of cortical circuit organization and function, and the history of how we came to our current understanding.

The outlook is inspiring. "By taking on such a grand challenge, this type of work involving hundreds of scientists, will generate results beyond our daily pursuits in the lab", says DeFelipe.

More information: Javier DeFelipe et al, Comments and General Discussion on "The Anatomical Problem Posed by Brain Complexity and Size: A Potential Solution", *Frontiers in Neuroanatomy* (2016). DOI: 10.3389/fnana.2016.00060