Scientists find way to map brain's complexity

Scientists say they have moved a step closer to developing a computer model of the brain after finding a way to map both the connections and functions of nerve cells in the brain together for the first time.

In a study in the journal Nature on Sunday, researchers from Britain's University College London (UCL) described a technique developed in mice which enabled them to combine information about the function of neurons with details of their connections.

The study is part of an emerging area of neuroscience research known as 'connectomics'. A little like genomics, which maps our genetic make-up, connectomics aims to map the brain's connections, known as synapses.

By untangling and being able to map these connections -- and deciphering how information flows through the brain's circuits -- scientists hope to understand how thoughts and perceptions are generated in the brain and how these functions go wrong in diseases such as Alzheimer's, schizophrenia and stroke.

"We are beginning to untangle the complexity of the brain," said Tom Mrsic-Flogel, who led the study.

"Once we understand the function and connectivity of nerve cells spanning different layers of the brain, we can begin to develop a computer simulation of how this remarkable organ works."

But he said would take many years of work among scientists and huge computer processing power before that could be done.

In a report of his research, Mrsic-Flogel explained how mapping the brain's connections is no small feat: There are an estimated one hundred billion nerve cells, or neurons, in the brain, each connected to thousands of other nerve cells, he said, making an estimated 150 trillion synapses.

"How do we figure out how the brain's neural circuitry works? We first need to understand the function of each neuron and find out to which other brain cells it connects," he said.

In this study, Mrsic-Flogel's team focused on vision and looked into the visual cortex of the mouse brain, which contains thousands of neurons and millions of different connections.

Using high resolution imaging, they were able to detect which of these neurons responded to a particular stimulus.

Taking a slice of the same tissue, the scientists then applied small currents to subsets of neurons to see which other neurons responded and which of them were synaptically connected.

By repeating this technique many times, they were able to trace the function and connectivity of hundreds of nerve cells in visual cortex.

Using this method, the team hopes to begin generating a wiring diagram of a brain area with a particular function, such as the visual cortex. The technique should also help them map the wiring of regions that underpin touch, hearing and movement.

John Williams, head of neuroscience and mental health at the Wellcome Trust medical charity, which helped fund the study, said understanding the brain's inner workings was one of science's "ultimate goals."

"This important study presents neuroscientists with one of the key tools that will help them begin to navigate and survey the landscape of the brain," he said.

(Reporting by Kate Kelland; Editing by Sophie Hares)