Scientists can now 'see' how different parts of our brain communicate

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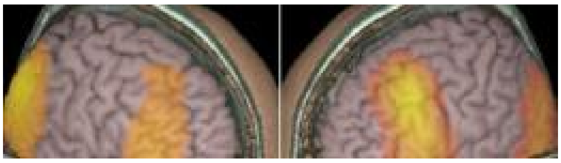

A new technique which lets scientists 'see' our brain waves at work could revolutionise our understanding of the human body's most complex organ and help transform the lives of people suffering from schizophrenia and ADHD.

Although, scientifically, the brain is the most studied organ in our body we still know relatively little about it. But that could all change as a result of this research led by Dr. Matt Brookes in the Sir Peter Mansfield Magnetic Resonance Centre at The University of Nottingham and published today, September 19 2011, in *Proceedings of the National Academy of Sciences* (*PNAS*).

Using a relatively new neuroimaging technique called magnetoencephalography (MEG) - which measures electrical signals from the brain - and a combination of new mathematical techniques they have found a non-invasive way to harness the rich, dynamic nature of brain signals - not just to identify the existence of brain networks, but also to probe the subtle electrical processes associated with brain activity.

They are already working with experts in the School of Psychiatry to apply these methods to patients suffering from schizophrenia and ADHD.

Dr. Brookes, a Leverhulme Trust Early Career Fellow who led the research, said: "If we are to go on to achieve a full understanding of brain networks and their role, an understanding of the electrical processes is critical. MEG does this non-invasively, via assessment of the magnetic fields induced outside the head by electrical currents in the brain.

"It is our hope that having identified a way of measuring network communication in healthy brains these same procedures can be carried out on patients. We hope these techniques will allow a novel, simple and non-invasive means to identify the network dysfunction associated with these two debilitating conditions."

In recent years the field of neuroscience has been revolutionised by the introduction of 'functional neuroimaging' - a collective term for a number of techniques that allow us to 'see' the brain at work.

A particularly exciting research area, developed over the last five years, involves using neuroimaging to measure brain activity in distributed processing 'networks' - the communication between separate brain regions. Accurate communication across the brain is integral to the way in which we function as human beings. Perturbed communication is indicative of disease. Therefore, the study of these brain networks is a highly important area of research.

To date most studies of networks have used functional MRI (fMRI), a technique which is based on magnetic resonance imaging and detects changes in blood flow brought about by changes in brain activity. However, the blood flow response that it measures is an indirect consequence of electrical function in brain cells and it is this electrical function which is of greater interest as it is the driving force behind communication in the brain.

With the use of MEG, Dr Brookes and his team at Nottingham, in collaboration with experts from the Oxford Centre for Human Brain Activity and the Oxford Centre for Functional MRI of the Brain at the University of Oxford together with The Wellcome

Trust Centre for Neuroimaging at University College London (UCL) have shown that electrical activity in the brain underlies the network connections previously observed in fMRI studies. They have also shown that a particular type of electrical activity - more commonly known as 'brain waves' - is integrally involved in network communication.

Dr. Brookes said: "Our method of investigating electrical brain signals is completely harmless to the subject and it offers exciting possibilities to probe the electrophysiological pathology that underlies neuropathological conditions."

Provided by University of Nottingham

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