Trauma experiences change the brain even in those without PTSD

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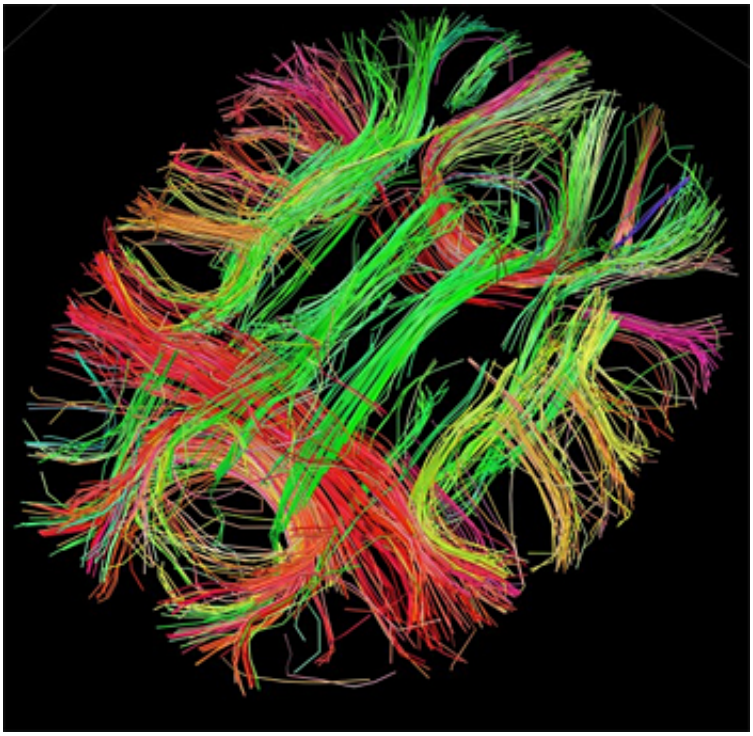

White matter fiber architecture of the brain. Credit: Human Connectome Project.

Trauma may cause distinct and long-lasting effects even in people who do not develop PTSD (post-traumatic stress disorder), according to research by scientists working at the University of Oxford's Department of Psychiatry. It is already known that stress affects brain function and may lead to PTSD, but until now the underlying brain networks have

proven elusive.

Led by Prof Morten Kringelbach, the Oxford team's systematic meta-analysis of all brain research on PTSD is published in the journal *Neuroscience and Biobehavioural Reviews*. The research is part of a larger programme on PTSD in British war veterans run by the Scars of War Foundation based at The Queen's College, University of Oxford. The foundation uses neuroscience to advance understanding of the effects of war and disaster.

The research team's initial survey of the scientific literature for all the published studies reporting brain activity in individuals with a diagnosis of PTSD yielded over 2000 records. This number was then reduced using stringent criteria to ensure the highest possible data quality for processing with meta-analytic tools.

The team separated studies by type of control group: trauma-exposed (those who had experienced trauma but did not have a diagnosis of PTSD) and trauma-naïve (those who had not experienced trauma), and compared the individuals with PTSD to both groups. This yielded an insight into how the abnormalities in functional brain activity in PTSD comprise a whole-brain network.

The analysis showed that there were differences between the brain activity of individuals with PTSD and that of the groups of both trauma-exposed and trauma-naïve participants.

This suggests that even in the absence of symptoms, trauma may have an enduring effect on brain function. Critically, the research found that in parts of a region of the brain called the basal ganglia, brain activity was different when comparing people with PTSD to the trauma-exposed group.

The findings suggest that the transition to clinical PTSD could be linked with imbalances specifically in the basal ganglia - but linked with imbalances in a larger brain network. This view has been reinforced by new evidence uncovered by the team using whole-brain computational modelling of other neuropsychiatric disorders. This modelling showed that these disorders lead to specific imbalances in specific brain networks.

Crucially, the meta-analysis has identified the need to directly compare trauma-exposed and trauma-naïve groups to identify potential biomarkers that could help early diagnosis and potentially novel treatments for PTSD.

Professor Kringelbach said: 'This research suggests that there may be a spectrum of traumatic effect on the brain, where people who have experienced trauma may not meet the threshold for a diagnosis of PTSD but may have similar changes within the brain. This could make them more susceptible to PTSD if they experience a subsequent trauma.

'While PTSD is often seen and portrayed as an issue for war veterans, it can affect other groups, including emergency service workers and refugees from conflict or disaster. By understanding how the brain is changed, we may be better placed to prevent the effects of trauma developing into clinical PTSD.'

PTSD often presents as a series of non-specific, confusing and distressing symptoms. The condition is therefore difficult for clinicians to differentiate from a wide variety of others. In particular among soldiers, PTSD can initially seem very similar to the effects of explosions and blows to the head. Mild traumatic brain injury (mTBI) and PTSD are especially common in soldiers and war veterans.

After the end of World War One, the Report of the War Office

Committee of Enquiry into "Shell Shock." announced the need to differentiate between the effects of trauma and brain injury. Resolving this long-outstanding question is an important part of the Scars of War Foundation's remit.

The new insights are guiding the research team's brain imaging study of British war veterans, which is about to start and which will compare veterans with PTSD to veterans both with and without trauma. Better understanding of the brains of war veterans is a vital first step in the Foundation's aim of providing clinicians with the means to make early diagnoses, while increasing the accuracy of early diagnoses has the potential to avoid the progression to intractable chronic versions of these conditions.

That could cut costs for war veteran care. It would also make possible the development of more effective treatments.

The Director of Scars of War Foundation and Falklands War veteran Hugh McManners commented: 'A possible implication of our research is that because trauma seems to lead to brain changes in everyone who is exposed, PTSD may not actually be abnormal or a 'disorder' but the brain's natural reaction to events and experiences that are abnormal. There may therefore be more 'natural' military and social methods of preventing and treating it. We hope to elucidate this further in the scanning phase of this project. More immediately, this could prove significant in helping to remove the stigma suffered by Service men and women who develop PTSD.'

More information: The paper, Stark E.A., Parsons C.E, Ehlers A., Van Hartevelt T.J., Charquero-Ballester M., McManners H., Stein A. & Kringelbach M.L. (2015) Post-traumatic stress influences the brain even in the absence of symptoms: A systematic, quantitative meta-analysis of neuroimaging studies is published in *Neuroscience and Biobehavioural*

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