



Biomarkers of human brain deregulation

DST's National Security Science and Technology Centre (NSSTC) fosters academic and industry partnerships to build national capability and enhance targeted delivery to Australian national security agencies.

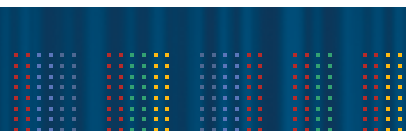
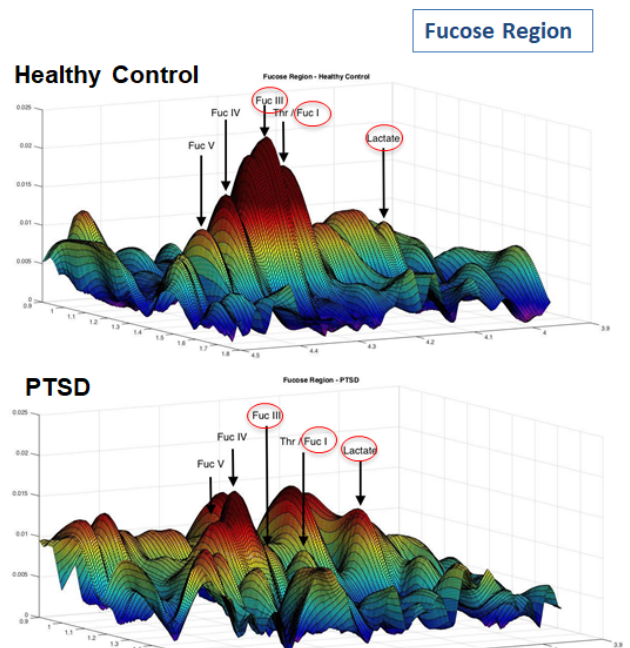
Australia and the US Defense agency, Combating Terrorism Technical Support office, is jointly funding a research project looking at the biomarkers of traumatic stress in the human brain.

This research is developing a novel tool to objectively evaluate and monitor how brain chemistry changes under traumatic stress, blast injury, physical impact and chronic pain, using Magnetic Resonance Spectroscopy (MRS). Understanding these changes would allow neurologists, psychologists and psychiatrists to provide personalised treatment to individual patients and most importantly assist in the early intervention of PTSD by diagnosis at the acute stage. This evaluation and monitoring tool will add great value to conventional diagnostic tools, such as questionnaires.

This research is conducted by an Australian multidisciplinary team led by Professor Carolyn Mountford, a world-leading medical researcher in the field of diagnostic imaging, at Queensland's Translational Research Institute.

Technology features

The figure to the right shows a small section of information obtained through 2D Localised Correlated Spectroscopy from two individuals. The top spectrum represents a healthy brain and the bottom is from a PTSD sufferer. The differences from the two groups data sets is that





Fucose I and III, which are assigned to Fucosylated Glycans, are reduced in intensity in the PTSD patient. These Fucosylated Glycans have been shown in animal models to be involved in learning ability, neuronal outgrowth and spatial memory. Lactate also appears in PTSD brains that could be an indication of stress.

The data is collected in a clinical magnetic resonance (MR) scanner. Data confirm that each condition (blast exposure, PTSD, mTBI and chronic pain) has a different pattern of neurochemical deregulation and/or damage. For example, the neurochemical effects from repetitive brain injury are different to blast injury soldiers though both injuries cause headaches.

Applications

Once the tool is fully developed, it could potentially be used for detection and early intervention with ADF, Special Forces and Police Force before and after their deployment, for developing and evaluating training programs, for assessing the effectiveness of treatments, and monitoring the recovery process.

Phase 1 is completed:

1. Four categories of personnel have been scanned: healthy control, PTSD, blast exposure (Artillery operators) and Special Forces.
2. Results have been peer-reviewed and presented at a number of international conferences.

Phase 2 is underway:

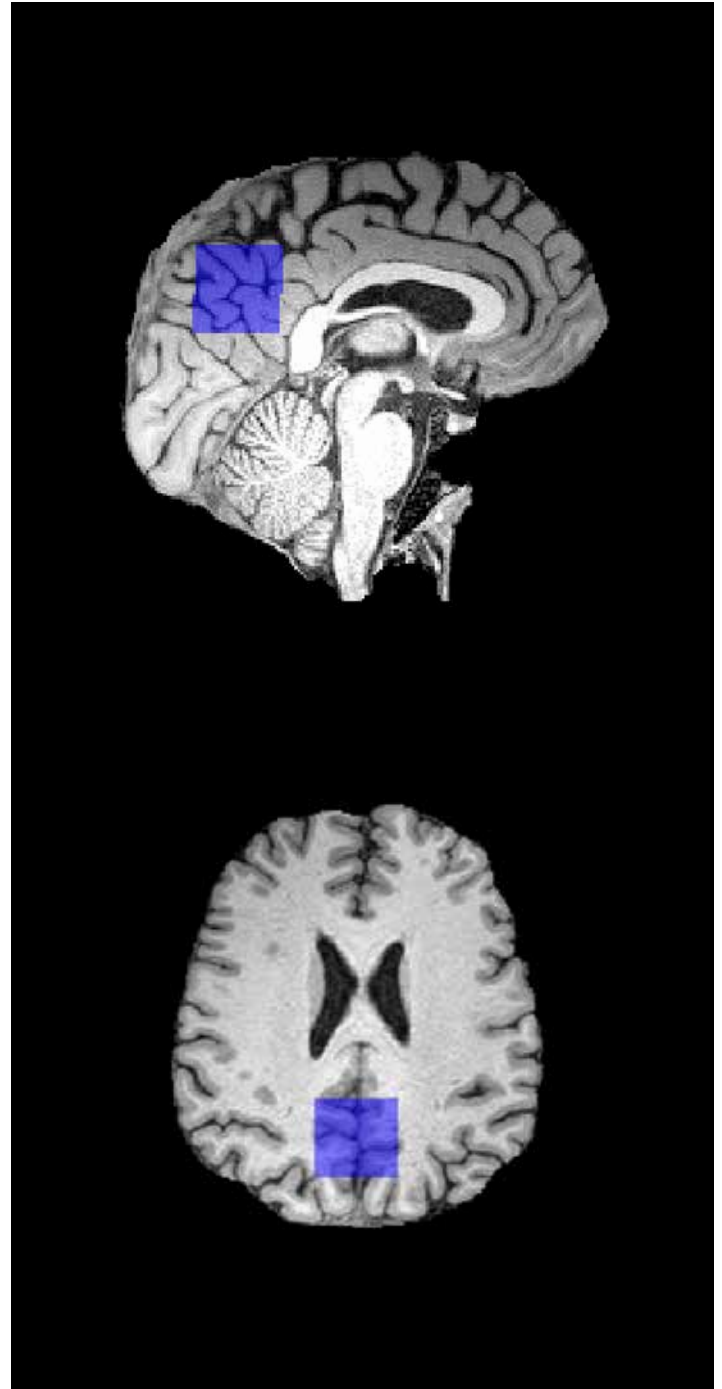
1. More scans are conducted and automated classifiers are under development for incorporation on the clinical scanner.
2. Brain chemistry changes from trauma exposure to Acute Stress Disorder to PTSD to be monitored using a range of MRI technologies.

Partnership opportunities

The study requires an additional 70 volunteers for each category with conditions of PTSD, blast exposures, and mild Traumatic Brain Injury.

For more information contact:

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This is the region of the brain where 2D spectroscopy is performed. This region is linked to spatial memory, configural learning, and maintenance of discriminative avoidance learning.