

## AL & VAL ROSENSTRAUSS FELLOWSHIP RECIPIENT

### DR SYLVIA GUSTIN

Dr Sylvia Gustin is a Senior Research Fellow at Neuroscience Research Australia and the School of Psychology, University of New South Wales. For the past 19 years she has been using brain imaging techniques to investigate the central circuits underlying chronic pain in humans. Her aim is to increase understanding of the development and maintenance of chronic pain, in particular psychological and central components and their association. Dr Gustin was awarded the Rebecca L. Cooper Medical Research Foundation Al and Val Rosenstraus Fellowship beginning in 2017 to understand and modulate the critical brain mechanisms that underlie chronic pain.

#### Research

Chronic pain is a significant problem worldwide, impacting one in three Australians. It results in enormous suffering and costs to the individual, as well as their loved ones and society in general. Unfortunately, despite the availability of pain medications and other pain therapies, there is still no ideal treatment that benefits the majority of sufferers, and most of the available therapies have significant side effects or risks for serious adverse events. For example, while most powerful drugs may provide up to 30% reduction in pain intensity, they also have multiple side effects that many patients choose to discontinue treatment. Thus, there is an urgent need to identify, develop, and evaluate new chronic pain therapies.

Dr Gustin's research program will address this need by developing and evaluating treatments that can provide pain relief via the primary source of pain: the human brain. Her research has identified biochemical, structural and functional alterations within the thalamus that are now known to play a key role in the generation of chronic pain. The thalamus is a small structure within the brain located just above the brain stem and acts as a gateway to and from the cortex. Dr Gustin has developed a new approach that targets these thalamic changes to ultimately treat chronic pain. In a new study she will modulate these thalamic changes via electroencephalography (EEG) based neurofeedback which she is hoping will lead to significant pain reduction. EEG based neurofeedback teaches individuals to gain control over their brain activity in a way that reduces their pain. Dr Gustin's overall aim is to definitively test whether a course of EEG based neurofeedback offers sustained pain relief for people with chronic pain. An important part of her project is a nested mechanisms study that applies causal mediation analysis to brain imaging data so that the precise brain processes that underlie therapeutic change can be identified.

Dr Gustin's research program also encompasses basic research. Her research has identified anatomical changes within the prefrontal cortex in chronic pain sufferers. The prefrontal cortex is the brain's major processing center for emotions and thoughts. In a new study she will determine the nature of these anatomical changes using state-of-the-art brain imaging techniques. The results from this study will provide evidence that anatomical changes within the prefrontal cortex underlie a decrease in GABA which is the major inhibitory chemical messenger in the nervous system. Establishing a decrease in prefrontal GABA is important because it provides new information which is needed to develop pain drugs that specifically target discrete brain regions, e.g. prefrontal cortex. Current pain medications are not targeted and therefore have significant side effects or risks for adverse events.