

TWIN-E Study: The Twin study of Wellbeing using Integrative Neuroscience of Emotion

Background on study

- *What is the study?*

The 'TWIN-E Study' is a large national prospective study coordinated by the Brain Dynamics Centre as part of the Westmead Millennium Institute and Discipline of Psychiatry, University of Sydney Medical School-Westmead. The investigators on this project including Professor Leanne Williams (University of Sydney Medical School), Professor Peter Schofield (Neuroscience Research Australia), Professor Richard Clark (Flinders University), A/Prof Anthony Harris (University of Sydney Medical School) and Dr Justine Gatt as Study Coordinator (University of Sydney Medical School). The study is funded by an ARC-Linkage grant (LP0883621), in collaboration with the industry organisation Brain Resource Ltd, and the Australian Twins Registry.

The study involves three main phases at present –

Phase I: A minimum of 1500 twins across Australia will be tested on a series of neurocognitive web-based tests and genetic DNA samples, with a subset from Sydney and Adelaide being tested on the brain imaging measures (EEG and MRI).

Phase II: To assess changes over time in the prediction of wellbeing and mental health, all 1500 twins will be reassessed on the web-based tests.

Phase III: To assess changes in wellbeing from brain training, each twin from a twin pair will be randomized to a treatment or control group. Twins in the treatment group will be recommended certain brain games to play for a 30-day period, tailored to their profile scores. Such brain training could include activities that focus on boosting positive emotion and affect, improving stress relief, and activities to boost memory and attentional abilities, for instance. After the 30-day period, twins in the treatment and control group will be required to do a repeat web-assessment to assess changes in wellbeing, and then both twins will have open access to the brain training.

- *How long has it been?*

Recruitment and testing begun in mid 2009, with Phase I completed in March 2012. Phase II and III are due to complete by mid-2013.

- *Why are we doing it?*

- To date, research in mental health has largely focused on identifying markers of risk for poor mental health and disease, rather than understanding what makes us resilient, healthy and happy. This is important to establish as mental health is not simply the absence of disorder. So we want to understand why some people are able to bounce back from difficult times in their lives.
- What makes this study unique is that we will be collecting a range of measures that include genetics, brain measures, body measures and behavior, in order to fully understand what underlies resilience and wellbeing.
- And this study is conducted in twins, that is identical and non-identical twins, so that we can understand “nature vs nurture”; that is, is it your genes that determines how resilient you are, or is it something positive or negative that happened to you as a child or during adulthood?

- *What have we found so far?*

- We have recently conducted some preliminary analyses in our first 50% of twins that have completed the MRI brain scans at Westmead Hospital, and we have found some interesting findings in terms of the role of nature vs nurture in determining the structure of different parts of the brain.

- What we have found is that genetics contributes more to some regions over others. And the difference seems to boil down to the speed of processing involved.
- So what we found was genetics contributes a lot more strongly to the structure of 'cortical' brain regions such as the frontal cortex, which is involved in controlled emotion processing and drives our behavior and coping mechanisms; that is, "our moods and how we react to different situations".
- In contrast, our environment (our life experiences) contributes more strongly to those brain regions involved in the first automatic, non-conscious processing of innate danger cues that signal "we may be in danger", such as a person with an angry face, or seeing a snake or spider. These are known as the subcortical regions of the brain such as the amygdala and brainstem and they function at a very fast time scale of <250ms and prepare our body for possible danger by raising our heart rate and autonomic system response. For these brain regions, it seems that environment plays a big role – so any trauma you may have been exposed to as a child or stressful life events during adulthood will impact how quickly we respond to 'danger cues', and to what cues we respond (ie only cues that are truly dangerous or other cues we believe or learn to be dangerous from our past life experiences (this includes people with phobias to things that are not relatively dangerous, such as the fear of lifts, flying or peanut butter stuck to the top of your mouth).
- What this suggests is that there is a lot of room for improvement through intervention. That is, we can train people to change the way they first respond to different danger cues, which hopefully would then have flow-on effects to the controlled processing and behavior.
- These results have been published special issue: Gatt et al., 2012. The TWIN-E project in emotional wellbeing: Study protocol and preliminary heritability results across four MRI and DTI measures. *Twin Research and Human Genetics*,15(3),419-441:
<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8614460&fulltextType=RA&fileId=S1832427412000126>

What we hope to achieve and why

1. To understand the genetics and biology that underlies risk versus resilience in mental health. That is, what are the profile of measures that describe someone at risk for mental illness, versus those who are resilient with optimal wellbeing and happiness? By assessing participants over a one-year period, we will be able to determine how positive and negative life experiences may impact on mental health outcomes, and the role of genetics in buffering these effects. From this information, we ultimately hope to be able to prevent people becoming mentally ill and to promote health and happiness even if they are exposed to known risk factors.
2. By including a brain training component, we will directly test whether resilience and wellbeing can be promoted over a short period via the use of simple online exercises. Brain training includes games and activities which focus on boosting positive emotion, improving stress relief and boosting memory and attention. We will test which neurobiological or genetic marker predicts who responds best to which training strategies. This will enable us to personalize the treatment to the individual. This research is important in promoting brain health as you would exercise to maintain physical fitness.