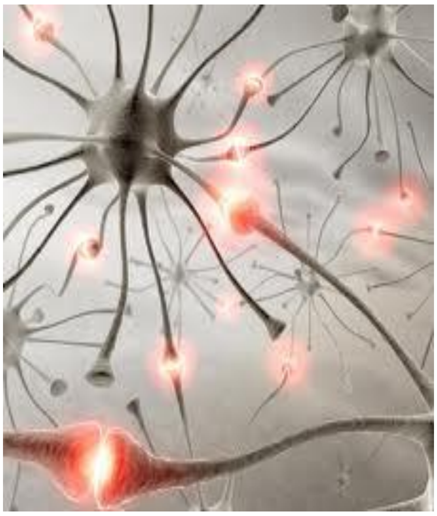
Neuroplasticity

What is neuroplasticity?

Neuroplasticity is a relatively new and very exciting discovery in the specialty that is neuroscience, and it can open up a whole world of possibilities to those who may previously have been beyond hope of rehabilitation.



The term neuroplasticity can be defined as the brain's ability to change its structure and function in response to an alteration in the brain itself, external forces or experiences. These external forces can be trauma, disease, or simply active retraining of the brain. Neural pertains to neurological functioning and nerves, and plasticity pertains to being malleable or mouldable.

Historically, medical consensus was that the brain only changes during childhood and adolescence and the adult brain is fixed, unchangeable and static apart from the inevitable decline that occurs with the ageing process. These theories were based on the fact that brain damaged patients rarely made much of a recovery, and that some psychiatric patients seemed beyond recovery and unlikely to improve.

Evidence of neuroplasticity however, has been abundant since the dawn of human kind in both positive and negative forms. Neuroplasticity can be of benefit to humans, it is how musicians improve at playing instruments with practice and how athletes hone their techniques. On the other hand, neuroplasticity can also be detrimental, playing a role in addiction formation and also in development of some conditions, such as tinnitus.

How does it happen?

Neuroplasticity is somewhat of an umbrella term. The changes described can happen on a cellular level or involve total cortical remapping. Functional neuroimaging or functional magnetic resonance imaging allows scientists to see increases and decreases in blood flow to certain areas of the brain, depending on the activity being undertaken by the individual. Functional neuroimaging has shown that undamaged regions of the brain can adopt the functions of those parts of the brain that have been damaged. The neurones rewire themselves by removing old connections that are no longer functioning and building new connections. As early as the 1960s and 1970s, scientists discovered that even in a healthy brain, structural changes take place according to the task the brain is performing. If some parts of the brain completed a certain task more effectively than an area originally doing the task, the brain would rewire itself so the more effective area would take over the task.

Examples of neuroplasticity at work

When an individual concentrates on an activity, they are rewiring their brains. By doing something repeatedly an action becomes learned, and moves from the learning centre to the centre for automatic activity. This is evident in tasks such as riding a bike or driving a car.

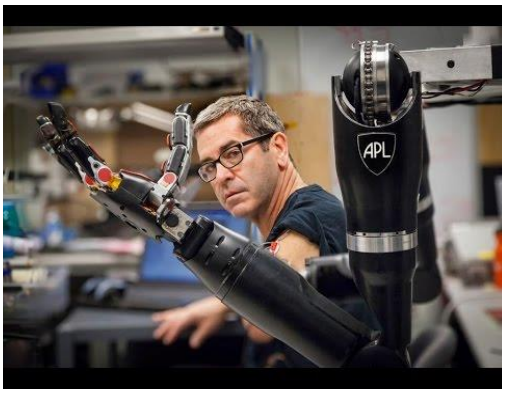
This phenomenon is even more obvious in individuals who lose a limb and learn to use a prosthesis and adapt to being without the limb. Some people who have had a recent amputation may suffer from phantom limb syndrome, where they still feel sensation and pain in the limb that no longer exists. This syndrome is usually brief, as it is thought that the symptoms are due to the brain's attempt to reorganise sensory information and should cease once the brain has successfully rewired itself to account for the change. Unfortunately, the syndrome can persist and cause chronic pain in some individuals.

When a patient suffers a stroke it can permanently damage any part of the brain. Stroke victims can be left with paralysed limbs due to the brain damage. For example, if a person suffers a stroke and there is damage to the motor cortex in the left hemisphere, it may result in paralysis or partial paralysis in the right side of the body. The discovery of neuroplasticity has given rise to therapies which harness the brain's ability to retrain itself. These new therapies, called mirror box therapies, are now used in rehabilitation programmes and take advantage of the brain's ability to make new connections to enable the affected arm or leg to regain movement. Click here to see the demonstration of the therapy.

Rewiring can also occur when a person becomes blind or deaf during their lifetime. The intact senses become far more acute as the brain no longer uses the sense that is damaged. For example, a blind person develops hearing that is more sensitive. When new learning is applied to skills already in place, the original learning areas begin working in the same way they did when there was no skill in that area to improve connections and improve skills. Attention is what alters and grows these brain circuits. This means the decision, consciously, to focus on something can alter the brain physically.

The Future

Neuroplasticity is one of the most exciting discoveries of our time and is set to change the face of rehabilitation, learning and therapy as we know it. In May 2012 an Australian magazine, The Age, published an article about a woman in the United States of America who used brain waves to control a robot arm. Rigged up with connecting wires from her motor cortex to the robotic arm, she lifted a drink to her mouth, just by thinking about it. This was reported to be the first voluntary movement this woman had produced in the fifteen years since her stroke. For more information, click here.



Our brains are extraordinary organs. Neuroplasticity is at the subject of ongoing research, with studies looking at different aspects including the reversal of symptoms of dementia and the testing of certain medications to enhance neuroplasticity.

LexiMed Consultants

- **Dr Leigh Atkinson**
  Neurosurgeon
- **Dr Martin Wood**
  Neurosurgeon
- **Dr Michael Redmond**
  Neurosurgeon
- **Dr Jan Paul Rotinen Diaz**
  Rehabilitation Physician
- **Dr Vernon Hill**
  Rehabilitation Physician

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Suite 30, Level 2, Silverton Place, 101 Wickham Terrace, Brisbane QLD 4000 l P.O Box 1225 Spring Hill 4004
T 07 3831 5681 l F 07 3831 5682 l www.leximed.com.au