Working together to promote brain recovery

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We so often think of the elderly when faced with the issue of tackling brain injury after stroke and in doing so we forget that stroke also strikes young people too, even children. But no matter what the age, the exciting reality is that many brain injuries no longer have to result in permanent loss of functions. We now know that the brain can be stimulated to remodel and repair. It is just finding the right combination of approaches to stimulate this response that remains to be clarified. So whilst there are no magic cures for brain injury, there are many new non-invasive therapies underway in clinical trials that are having some dramatic and surprising results in promoting brain recovery, even many years after the initial stroke event.

It is important to get to a hospital quickly if you are having a stroke. This is because restoration of blood flow to the affected brain region can ultimately reduce the extent of injury that may occur. However this is not always possible, as many people live long distances from medical care or do not even know that they are having a stroke when it occurs. There have been many public campaigns to promote the signs of stroke to tackle this issue, with the most commonly publicized clinical signs being: Can you smile, can you raise your arms above you head, and can you speak your name? If a person is unable to perform these tasks then chances are they may be having a stroke, and if detected early, medical intervention can reduce the loss of function associated with stroke induced brain injury. However, it was for a long time thought that if stroke was not detected early, then nothing could be done (apart from preventing repeated episodes) and that irreversible brain damage would ensue with permanent loss of functions. As is so often the case in science, what we think we know doesn't always turn out to be the case. In fact a slow but consistent recovery can be observed in stroke patients during rehabilitation over months without pharmaceutical intervention. Research now suggests that the injured brain is primed for repair processes and that brain rewiring can now be stimulated to occur, even years after the damage, through intensive physical re-habilitation and environmental enrichment.

Rewiring the brain requires stimulation of surviving nerve cells just outside of the injured territory in order to encourage these cells to make new connections with different cells. To this affect bypassing the damaged site to restore lost functions. Whilst existing brain and physical exercises have been important in helping with this process, new approaches are currently in trial. One such approach is the use of 'Constraint-Induced Movement Therapy', developed by Dr. Edward Taub, and is mostly used for re-development of motor activities. This process involves combined restraint of the unaffected limb with intensive use of the affected limb, in order to force the affected arm to ‘learn’ how to work again. It’s not an easy process, since it requires nearly all waking hours with long periods of supervised structured tasks involving the affected limb over many weeks. For many, however, persistence pays off, and positive results are being reported with constraint therapy even in people who have been disabled for many years. Two key factors have emerged as being vital for its success; these include complete concentration on repetitive tasks, and compliance to constraining the functional limb for 90% of waking time. More research is required to determine if the later part of the protocol is truly necessary, and that perhaps repetitive tasks applied to the affected limb alone would be sufficient itself to improve recovery.

Another approach to brain rewiring may also be found with the use of device-orientated approaches. These utilize similar technology to that used in cochlea implants, which enable the hearing impaired to hear for the first time. The use of bionics has long been bridging the gap between what is and what is not possible. In a recent new discovery, a novel electronic microsystem implanted into the damaged brain has been shown to bridge the gap between disconnected brain regions, resulting in restored function. Additionally the device also served to guide new nerve fibres in the right direction, in order to re-map a lost pathway and restore its connections, to the extent that when the device was turned off, long-term restoration of motor function was achieved. While these latest studies have only been tested so far in animal models, electronic devices placed on the tongue have been used in humans to restore loss of balance associated with small brain lesions. It is therefore not out of the question that smart prosthetic devices may in the future have an application in human stroke.

We once thought that the human brain was hard-wired with fixed functions, and if damaged, these functions were irreversibly lost. Decades of research have now shown this to be untrue, and that lost functions may be restored if given the right opportunity. But there is not going to be just one ‘right’ approach to fix the complex problem of brain injury. It will take a combination of approaches that may incorporate the use of multiple technologies. It will take ongoing collaboration of experts across many fields of science working together. But where once the problem appeared beyond resolution, we now know that there is hope, and with new ideas we are already starting to see brain recovery occurring in many people, where previously none was thought possible.