Re-thinking the wiring of our brain: *A response to The Brain that Changes Itself*

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It is easy for us to look at an infant and believe that they are forming and strengthening neuronal connections with every look at the world, but until recently you would have never believed the same could be true for adults as well. This belief in the hardwired brain led us to think that adults were never able to change the way their brain functions, and brain damages caused by neurodiseases were incurable. However, as Norman Doidge, M.D. points out in *The Brain That Changes Itself,* the belief that the brain is fixed is no longer the notion in the scientific field. *The Brain That Changes Itself* describes the challenges that the pioneers of plasticity faced, and the thrilling successes experienced by patients that led the shift in the neuroscience paradigm that the brain is a not hardwired machine, but rather a malleable piece of play-doh.

Norman Doidge, M.D. is a psychiatrist, psychoanalyst, and researcher at the Columbia University Center for Psychoanalytic Training and Research in New York and at the University of Toronto's department of psychiatry and clearly has the talent for story telling. One of the most intriguing stories told in chapter two of Barbara Arrowsmith Young who was "Building Herself a Better Brain." Barbara Arrowsmith Young had a number of serious learning disabilities as well as visual disabilities that she struggled with since childhood. Barbara's most debilitating problem was her inability to understand the relationships between symbols. Although her inability to conceptualize caused Barbara problems throughout her childhood and even early into her adult life, she had an impeccable memory and a drive to teach herself and others how to build better brains. The Arrowsmith School uses brain exercises to correct learning disabilities in children and serves as proof that the brain can be modified like a piece of play-doh. In just eleven short chapters, Doidge tells the progression of how plasticity came to be more widely accepted all the meanwhile describing the enthralling stories of patients, like Barbara, who have recovered from strokes, regained their vestibular systems, overcome their emotional disabilities, and in one extraordinary case live with only half a brain.

Doidge does a fantastic job at describing the science in a way that is simple, yet fascinating, and completely draws you in. Doidge describes the methods that the frontiers of neuroscience used to argue that the brain is in fact plastic and makes you empathize with the scientist just as much as you do to the patients. The recount of the efforts of Edward Taub, a behaviorist who developed constraint-induced therapy, is a perfect example of how Doidge draws you in to the struggles of the scientists. Taub developed constraint-induced therapy for stroke victims to regain motor function after many trials using monkeys. By cutting the sensory nerves in the monkeys, no input would be related back to the spinal cord and the monkeys would not feel where their arm was in space. This technique, called deafferentation, mimics the effects that are seen in stroke patients. Taub and his team deafferented a monkey's arm and then place the monkey's working arm in a sling. Miraculously the monkeys began using their deafferented arm to feed themselves and move around. Doidge describe the rest of the experiments Taub and his team used to prove that the brain is plastic enough to learn how to use afflicted limbs. Constraint-induced therapy is now widely used in the treatment of stroke victims to teach them how to regain motor function in limbs that have been neurologically damaged through exercises that restrict the movement of the good limb so patients, much like the monkeys, are forced to use their afflicted limb. However compelling their evidence was, frontiers like Edward Taub were disproving widely accepted theories and changing the way people thought about the brain, which was not as supported as you, might think.

Through topics like sexual attraction, learning and memory, compulsions, and the perception of pain it ishard to find a chapter that you cannot relate to in some way. Doidge discusses each topic in a self-help approach that makes the reader reflect on how it applies to them, or someone they know, or how it could apply to them in the future. One of the most interesting topics about how the brain can be modified wasn't raised until the appendix. In appendix 1, Doidge talks about how the brain shapes culture and how culture subsequently shapes the brain. Of course the brain produces culture, but what is even more interesting is that the definition of culture is to cultivate the mind. Evidence for the cultural shaping of our brains exists in musicians. For example, over time a string musician will develop a larger brain map for their left hand, and a larger brain area connecting the left and right hemisphere if practicing began before the age of seven. Even taxi drivers have been reported to have a larger hippocampus, which is the part of the brain that stores memory. Doidge makes you reflect about how we live our day-to-day lives, and how it affects our brain plasticity as we live and as we age.

It is easy to think of the brain as a biologically set organ that is contained in the skull of a human being, and it is this kind of thinking that Doidge points out is the reason for the delay in the discovery of plasticity. The reflection that Doidge enables can be found in a multitude of places throughout *The Brain That Changes Itself,* and finding those pieces are the most beneficial pieces of the book. As a reader you begin to question your previous thoughts on how easily influenced your brain truly is to the culture and environment that is our day-to-day lives, and that amount of influence is baffling. As a student fascinated by the mystique of the plastic brain find it thrilling that we are starting to uncover of some of the basic mysteries that have been around for decades.

With every chapter I found myself in awe of what pioneers in the field and patients with neurological diseases were able to achieve in the dark ages of plasticity, and wanting to tell anyone who would listen about the fascinating discoveries that were described on every page. It is almost impossible not to put this book down, challenge your mind to understand the theories, and pass the information along to a friend. This book is a great tool to use to learn the history of the theories behind plasticity, as well as perk your interest in the subject altogether.