Designs For Strong Minds
484 Hillside Drive • Highland Park • Illinois 60035 • V: 847-433-7878 • F: 847-433-6760

Mediation is Essential to Develop Brain Plasticity

By Donalee Markus, Ph.D.

Brain plasticity = ability of the brain to "rewire" itself. This capability occurs predominately in the frontal lobes, the area of the brain right behind the forehead and above the eyes. Although they make up 40% of the volume, the frontal lobes were the last part of the human brain to evolve. They don't become fully operable until the late teens or early twenties. They provide our sense of self-awareness, our will power, and our humanity. They enable us to plan, prioritize, and conceive the future. Damage to the frontal lobes can deprive us of choice, intention, and conscience.

Professor Michael Merzenich of San Francisco, the world's leading researcher in brain plasticity, discovered that animals' brains that are passively stimulated aren't significantly changed by experience. The "rewiring" occurs only when attention is given to the stimulation. In other words, to make a change we have to be actively attentive.

The "attention circuits" of the human brain are located primarily in the frontal lobes. Here the initial stages of learning take place. With attentive and adequate rehearsal, the process then shifts to other parts of the brain, freeing the frontal lobe circuits for the further acquisition of new skills.

The frontal lobes also play an important role in selecting what sensory input to attend to—emphasizing certain stimuli while ignoring others. The ability of"tuning in" and/or "tuning out" structures our perceptions of external and internal events. Damage to the frontal lobes can affect our ability to evaluate, prioritize, and differentiate relevant from irrelevant information.

One cost of "paying attention" is that activities in other areas of the brain are significantly reduced. When we listen intently, we become blind and numb to the world around us. When we focus on minute details, we lose sight of the big picture. We may get so lost in a book or a movie that we lose all sense of time and place. This effect is called "Hebbian learning," after psychologist Donald Hebb. The changes that take place in brain cells and synapses as a result of Hebbian learning is called "long-term potentiation" (LTP).

On a neural level, neighboring cells begin "firing" simultaneously, kind of empathically, even if only one of them receives the initial electro-chemical stimulation. In *Mind Sculpture: Unlocking Your Brain's Untapped Potential*, brain rehabilitation researcher Ian Robertson described this phenomenon as "Cells that fire together, wire together." On a metaphoric level, a coalition of actively firing cells will commandeer their more passive neighbors, enlarging the web of influence a specific stimulus can produce. On a conscious level, we experience a "zeroing in" on particular objects or events. For example: mothers can easily identify the sound of their children's voices even in a crowded and noisy playroom. And we all respond attentively when we hear our names mentioned.

Research with musicians who play string instruments demonstrated that while a larger than average part of their brains were devoted to the fingers of their left hands, it resulted in a less than average sensitivity in their left palms. Likewise, the folk adage that a loss of one sense, such as sight, leads to the enhancement of other senses has been scientifically justified by evidence that visual areas of a blind person's brain are taken over by touch when he learns Braille.

The commandeering of brain cells that results in the acquisition of new skills can be disrupted if we are not allowed to dream. Although REM (rapid eye movement) sleep takes up just 20% of the night, research indicates that without such dreamtime learning and memory suffer. This is why cramming all night for a final may get us through the test but does nothing to enhance our understanding of the subject matter.

The same does not hold true if non-REM sleep is disrupted. We may be tired and cranky, but our memories will still function. Hence, it is not enough to "sleep on it," we have to "dream on it" to make significant changes within our brains.

Neural networks that are derived from experience or practice will break down from disuse, or as Robertson said "Cells that fire apart, wire apart." This is why we may remember only snatches of old, familiar songs or experience a sense of "being rusty" at things we used to do so well. Brain cells don't whither away when unused. They are simply commandeered for other purposes. In weightless space, astronauts lose their kinesthetic sense of direction. Without gravity, they have no "this side up" cue. They have to depend entirely on their eyes to orient themselves as they float freely in the space shuttle. After an extended time in a space lab, they even lose the sense of their limbs. They have to look to see where their arms and legs are. This is why astronauts "walk funny" when they finally return to Earth. On average, it takes four to eight days for their brains to "rewire" under the influence of gravity.

This extraordinary, and until recently, unrecognized capacity our brains have for continually restructuring themselves holds great promise for people with traumatic brain injuries (TBI). In some cases, neural networks that have been 90% damaged have reorganized into functioning systems again. They do so by "working around" the dead cells and joining together with surviving neighbors.

As might be expected, higher and broader education provides a significant advantage when it comes to overcoming brain injuries. The more connections there are and the stronger those connections are, the more likely a patient will recover functional capacity, provided that the therapy is progressively organized. Sporadic or poorly organized treatment is like knitting and then unraveling a sweater. It may keep us busy, but in the end nothing has been achieved.

The most effective form of teaching, and subsequent brain restructuring, is mediation. The mediator is a kind of external frontal lobe, selecting and highlighting what is significant, downplaying or concealing what is distracting. *Designs for Strong Minds* and *Learning How To Learn* exercises are designed to do just that and more. They are organized progressively and around different logical structures. Think of them as a full brain workout, cross-training and restructuring the brain to maximize potential naturally.