Neuroplasticity—Keys and Enhancers

Neuroplasticity is, simply put, the capacity of the brain to change throughout life. It can occur on a variety of levels, ranging from changes due to learning or growth, to large-scale changes in response to injury. While for most of the 20th century general consensus among neuroscientists was that brain structure is relatively unchanging after early childhood, current understanding is that many aspects of the brain remain plastic—that is, changeable—even into adulthood.

Extensive research has found there are certain keys to neuroplasticity, without which it is more difficult (and sometimes impossible) for the brain to make neuroplastic changes. There other aspects which assist with or enhance the process. In both cases, the more keys/aspects, the better.

Five Keys to Neuroplasticity
The following five keys are necessary to the process of making new neural connections. The more one of more of these keys is compromised, the harder it will be for the brain to stay flexible, healthy and cognitively sharp, especially through aging and stress.

1. Exercise
Exercise improves blood flow and increases oxygen levels, which increase neuron growth. (The brain is only 2% of our body mass but it consumes 20% of our oxygen and nutrients.) Exercise also increases the volume of white and grey matter in the brain, by increasing brain-derived neurotropic factor (BDNF), which is necessary to neuronal growth. A minimum of 30 minutes three times a week is generally recommended, although shorter workouts of more intensity and longer with less are helpful as well.

2. Sleep
A healthy adults needs between 7-9 hours of sleep (Teens need 8.5 – 9.25 hours). During sleep our brain has the chance to integrate learning and also combs through information and decides what is needed and what is not. Neural impulses are literally reversed from our waking state, which serves to both clean out unneeded information and prime the cells for learning and memory in the future.

3. Food
The brain needs Omega-3s and vitamins from foods to create new neural pathways. It's also critically important to stay away from foods and substances that inhibit neural growth and/or create inflammation. According to new research, aspartame and other artificial sweeteners, high fructose corn syrup, alcohol, vegetable oils and many grains may all contribute to non-optimal brain states. Promising research finds coconut oil, berries, B vitamins (and much more) helping to build neural connections in the brain.

4. Novelty
New experiences stimulate neuronal connections. If we don't know how to do something, the cognitive patterns for it don't exist in our brains, thus new connections must be made. In order to

maintain the benefits, however, these experiences have to increase in challenge in order to create new growth. Additionally, we simply don't pay attention to things that are boring!

5. Focus and Attention
The close paying of attention (as in study, meditation and focused attention) increases neurotransmitters (such as BDNF, mentioned above in the Exercise section) responsible for creating new neural connections. In addition, many studies have linked meditation practice to differences in cortical thickness or density of gray matter.

Four Enhancers to Neuroplasticity
The following four enhancers are extremely helpful to the process of making new neural connections. The more we have of each, in combination with the five keys, the easier it is to learn, remember, and change.

1. Relationships
We learn and change best in safe, supportive relationships. Feeling socially connected diminishes stress and can even reduce inflammation, while feeling judged or "less than" others creates fight or flight responses in the brain which inhibit learning. When we feel we are being heard and understood, it increases the connective neural fibers in our brains—fibers that are crucial for bringing together disparate areas for increased cognitive function.

2. Mistakes
A critical part of the learning process is the ability to try, fail, recalibrate and try again. This is literally how the new neural connections we make get either strengthened or pruned. According to Daniel Coyle in *The Talent Code*, training "at the edge of our abilities" produces results up to 10 times faster than regular practice. That is, making mistakes leads to better skill acquisition. Directly linked to the key of **novelty**, making mistakes is inherent to increasing the difficulty of the task. As long as we are making mistakes, the task is probably challenging enough.

3. Humor/Play
Humor relaxes and bonds us, and is a wonderful ally in helping to overcome the brain's strong negativity bias. Laughter has been shown to release oxytocin, which not only makes us feel more bonded and connected and trusting, it's also a great anti-inflammatory agent. Good humor also often plays upon the unexpected, causing us to think in new ways (**novelty**). Similarly, being playful puts the brain in an open state for learning. All baby animals and humans learn through play, which allows **mistakes** to be made and learned from in a safe environment.

4. Multi-Sensory Input
The more multi-sensory neural connections we have associated with a behavior or skill, the stronger the "pathway" becomes by engaging more aspects of the brain. For example, when we remember a vacation to the beach, we may access sounds, smells, sights, even the feeling of sand on our toes. This anchors in the experience more strongly than simply seeing a photo of sand and waves. When we are intentionally working to create positive new neural pathways, bolstering this process by bringing in as many of our senses as possible is a fabulous strategy.

Coming soon: a complete bibliography of studies supporting these keys and enhancers. Stay tuned!