Brain Plasticity: How learning changes your brain
(Michelon, 2008)

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You may have heard that the brain is plastic. As you know the brain is not made of plastic! Neuroplasticity or brain plasticity refers to the brain’s ability to CHANGE throughout life. The brain has the amazing ability to reorganize itself by forming new connections between brain cells (neurons).

In addition to genetic factors, the environment in which a person lives, as well as the actions of that person, play a role in plasticity.

Neuroplasticity occurs in the brain:
1- At the beginning of life: when the immature brain organizes itself.
2- In case of brain injury: to compensate for lost functions or maximize remaining functions.
3- Through adulthood: whenever something new is learned and memorized

Plasticity and brain injury
A surprising consequence of neuroplasticity is that the brain activity associated with a given function can move to a different location as a consequence of normal experience, brain damage or recovery.

In one of them, a surgeon in his 50s suffers a stroke. His left arm is paralyzed. During his rehabilitation, his good arm and hand are immobilized, and he is set to cleaning tables. The task is at first impossible. Then slowly the bad arm remembers how too move. He learns to write again, to play tennis again: the functions of the brain areas killed in the stroke have transferred themselves to healthy regions!

The brain compensates for damage by reorganizing and forming new connections between intact neurons. In order to reconnect, the neurons need to be stimulated through activity.

Plasticity, learning and memory
For a long time, it was believed that as we aged, the connections in the brain became fixed. Research has shown that in fact the brain never stops changing
through learning. Plasticity IS the capacity of the brain to change with learning. Changes associated with learning occur mostly at the level of the connections between neurons. New connections can form and the internal structure of the existing synapses can change.

Did you know that when you become an expert in a specific domain, the areas in your brain that deal with this type of skill will grow?

For instance, London taxi drivers have a larger hippocampus (in the posterior region) than London bus drivers (Maguire, Woollett, & Spiers, 2006).... Why is that? It is because this region of the hippocampus is specialized in acquiring and using complex spatial information in order to navigate efficiently. Taxi drivers have to navigate around London whereas bus drivers follow a limited set of routes.

Plasticity can also be observed in the brains of bilinguals (Mechelli et al., 2004). It looks like learning a second language is possible through functional changes in the brain: the left inferior parietal cortex is larger in bilingual brains than in monolingual brains.

Plastic changes also occur in musicians brains compared to non-musicians. Gaser and Schlaug (2003) compared professional musicians (who practice at least 1 hour per day) to amateur musicians and non-musicians. They found that gray matter (cortex) volume was highest in professional musicians, intermediate in amateur musicians, and lowest in non-musicians in several brain areas involved in playing music: motor regions, anterior superior parietal areas and inferior temporal areas.

Finally, Draganski and colleagues (2006) recently showed that extensive learning of abstract information can also trigger some plastic changes in the brain. They imaged the brains of German medical students 3 months before their medical exam and right after the exam and compared them to brains of students who were not studying for exam at this time. Medical students’ brains showed learning-induced changes in regions of the parietal cortex as well as in the posterior hippocampus. These regions of the brains are known to be involved in memory retrieval and learning.