EDITORIAL

Neuroplasticity: Evolving Concept in Neurology

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Neuroplasticity, also known as neural plasticity or brain plasticity is the ability of neural networks in the brain to change through growth and reorganization.[1] These changes range from individual neuron pathways making new connections, to systematic adjustments like cortical remapping. The term plasticity was first applied to behavior in 1890 by William James in *The Principles of Psychology*.[2] The first person to use the term neural plasticity appears to have been the Polish neuroscientist Jerzy Kanjorski.[3,4]

The human brain is composed of approximately 100 billion neurons. Early researchers believed that neurogenesis, or the creation of new neurons, stopped shortly after birth. Today, it's understood that the brain's neuroplasticity allows it to reorganize pathways, create new connections, and, in some cases, even create new neurons. There are two main types of neuroplasticity:[5]

1. **Functional plasticity:** It is the ability of brain to alter and adapt the functional properties of neurons. The changes can occur in response to previous activity (activity-dependent plasticity) to acquire memory or in response to malfunction or damage of neurons (maladaptive plasticity) to compensate a pathological event. In the latter case the functions from one part of the brain transfer to another part of the brain based on the demand to produce recovery of behavioral or physiological processes.[6]
2. **Structural plasticity:** It is the brain's ability to actually change its physical structure as a result of learning. Researchers nowadays use multiple cross-sectional imaging methods (i.e. magnetic resonance imaging (MRI), Computerized Tomography (CT)) to study the structural alterations of the human brains.[5] This type of neuroplasticity often studies the effect of various internal or external stimuli on the brain›s anatomical reorganization.

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The adult brain is not entirely "hard-wired" with fixed neuronal circuits. There is evidence that neurogenesis (birth of brain cells) occurs in the adult, rodent brain- and such changes can persist well into old age.[7] The evidence for neurogenesis is mainly restricted to the hippocampus and olfactory bulb, but research has revealed that other parts of the brain, including the cerebellum, may be involved as well.[1] However, the degree of rewiring induced by the integration of new neurons in the established circuits is not known, and such rewiring may well be functionally redundant.[9]

Neuroplasticity is gaining popularity as a theory that, at least in part, explains improvements in functional outcomes with physical therapy post-stroke. Rehabilitation techniques that are supported by evidence which suggest cortical reorganization as the mechanism of change include constraint-induced movement therapy, functional electrical stimulation, treadmill training with body-weight support, and virtual reality therapy.

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