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# Aging, Neuroplasticity and Neuro Rehabilitation

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As we aged the brain tissue undergoing degeneration that includes nerve cells and synapses. Progressive nerve cells deterioration occurs due to a wide range of intrinsic and extrinsic factors such as stochastic or randomized events, genetic profile and environmental factors (e.g., smoking, alcohol) and life style (e.g. physical inactivity, unchallenged cognitive stimuli). Aging brain often creates temporary and permanent impairment, functional disability and personality changes which can vary greatly in severity and progressively [1]. Traumatic/pathological events such as Stroke, Parkinson and Alzheimer can cause harm and deficiency to various parts of the brain responsible for motor control (poor balance, lacks coordinative movements) speech and language (aphasia), thinking (confusion, puzzlement), learning, mental fatigue, attention, judgment, problem solving (agnosis, apraxia), sleeping, eating, mood (e.g., melancholy, depression) and behavioral changes (e.g., stress, anxiety, fear, loneliness/isolation) [2].

Aged brain can learn and relearn due to phenomenon known as 'Neuroplasticity'. Neuroplasticity is done by developing of new synaptic connections and creating new pathways in the brain. Even though the neuroplasticity appears mostly right after birth and during the first years of life, our brain ability to learn new skills and to adopt behavior continues even as we aged, yet the capability and speed of learning and relearning is likely to lessen and slow down. 'Neuroplasticity' is possible due to two main neurophysiological processes: Neurogenesis and Synaptogenesis [3-5].

Health promotion and disease prevention are important parts in 'neuro rehabilitation' (NR) [6]. NR is a comprehensive process involves multi disciplinary team which aims to educate, train and encourage brain plasticity, thus minimizing the risks for any functional and cognitive alterations [7]. Neurorehabilitation is carry out in the frame work suggested by international classification of function, health and diseases (ICFHD) and its ultimate goal is to improve quality of life, to allow individuals the most independent life possible and social participation [8].

Physical exercise [9], healthy diet [6], cognitive activities, mindfulness [10] can influence brain plasticity by facilitating neurogenerative, neuroadaptive, and neuroprotective processes.

For neurorehabilitation to succeed it requires the old person to learn and to practice. But learning in old age is not that simple [11,12]. Formal and non formal learning is a process of change rather than a collection of factual and procedural knowledge, where a person is acquiring new knowledge, behaviors, or skills. Progress over time tends to follow learning curves. For human being and survival, learning is essential and crucial, yet it is done in contextual manner [13]. It does not happen all at once, but builds upon and is shaped by what already know. Brain learning produces electrical, chemical and structural changes (e.g. single receptors, adapter proteins, G-proteins and ion channels, intramembrane receptors) that finally, hopefully, produced a relative permanent change, which represent 'long term memory' [14].

So how aged brain can learn in the most effective manner? One of the most effective tools is the use of biofeedback. The biofeedback device offers external (i.e., augmented information provided by an external source) and internal feedback (i.e., response-produced) training an interactive, motivated and safety way to explore and re-learn motor skills [15] and cognitive capacities [16]. External feedback is often categorized as 'knowledge of performance' (KP) or 'knowledge of results' (KR).

KP refers to information provided to a performer during the activity/task/movement, and it includes information about suitability, accuracy, efficiency, quickness and velocity. KR is augmented information provided to a performer after the activity/task/movement was concluded [17]. KR focuses at the success level of the task [18], so eventually it provides a quantity score (in arbitrary points, %, etc), Typically, KR is also verbal ("great job"), hearing (applause) or visual feedback (such as green color for good performance and red color for poor performance). For biofeedback to be most effective and beneficiary for old person it should include several functional features or roles: 1) motivation 2) challenge point framework 3) associative function 4) guidance 5) assurance of safety and simple and easy to use 6) affordable and customer service 7) proved by clinical trials.

In order for new synapses and pathways to be formed and developed, neurons must be stimulated. Certain ways of administering feedback can activate this growth. Exercising the brain by repeated and varies practices makes outcomes better. Practice types are divided into 4 main categories: 1) Blocked practice- a series of identical tasks 2) Random practice- a series of different tasks 3) Distributed practice – more rest time than practice time 4) Massed practice- more practice time than rest time. Feedback can improve neuro rehabilitation if 'reaction time' is practiced. Biofeedback exercise can affect reaction time, attention, general cognition, memory, and several other measures of mental function [19].

In summery, to take full advantage of brain plasticity a bio feedback therapy is needed to enhance and improve cognitive abilities and motor performance.

## References

1. Dorszewska J (2013) Cell biology of normal brain aging: synaptic plasticity-cell death. Aging ClinExp Res 25: 25-34.
2. Mora F Segovia G, del Arco A (2007) Aging, plasticity and environmental enrichment: structural changes and neurotransmitter dynamics in several areas of the brain. Brain Res Rev 55: 78-88.
3. Bruel-Jungerman E Davis S, Laroche S (2007) Brain plasticity mechanisms and memory: a party of four. Neuroscientist 13: 492-505.
4. Lista I Sorrentino G (2010) Biological mechanisms of physical activity in preventing cognitive decline. Cell MolNeurobiol 30: 493-503.
5. Lu B Nagappan G, Guan X, Nathan PJ, Wren P (2013) BDNF-based synaptic repair as a disease-modifying strategy for neurodegenerative diseases. Nat Rev Neurosci 14: 401-416.

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6. Desai AK Grossberg GT, Chibnall JT (2010) Healthy brain aging: a road map. ClinGeriatr Med 26: 1-16.
7. Stuss DT (2011) The future of cognitive neurorehabilitation. Neuropsychol Rehabil 21: 755-768.
8. Tempest S McIntyre A (2006) Using the ICF to clarify team roles and demonstrate clinical reasoning in stroke rehabilitation. DisabilRehabil 28: 663-667.
9. Dishman RK Berthoud HR, Booth FW, Cotman CW, Edgerton VR, et al. (2006) Neurobiology of exercise. Obesity (Silver Spring) 14: 345-356.
10. Karp JF Shega JW, Morone NE, Weiner DK (2008) Advances in understanding the mechanisms and management of persistent pain in older adults. Br J Anaesth 101: 111-120.
11. Kitago T Krakauer JW (2013) Motor learning principles for neurorehabilitation. HandbClinNeurol 110: 93-103.
12. Archibald N Miller N, Rochester L (2013) Neurorehabilitation in Parkinson disease. HandbClinNeurol 110: 435-442.
13. Hedges JH Adolph KE, Amso D, Bavelier D, Fiez JA, et al. (2013) Play, attention, and learning: how do play and timing shape the development of attention and influence classroom learning? Ann N Y Acad Sci 1292: 1-20.
14. Agnati LF, Franzen O, Ferré S, Leo G, Franco R, et al. (2003) Possible role of intramembrane receptor-receptor interactions in memory and learning via formation of long-lived heteromeric complexes: focus on motor learning in the basal ganglia. J Neural Transm Suppl : 1-28.
15. Loureiro RC Harwin WS, Nagai K, Johnson M (2011) Advances in upper limb stroke rehabilitation: a technology push. Med Biol Eng Comput 49: 1103-1118.
16. Faucounau V Wu YH, Boulay M, De Rotrou J, Rigaud AS (2010) Cognitive intervention programmes on patients affected by Mild Cognitive Impairment: a promising intervention tool for MCI? J Nutr Health Aging 14: 31-35.
17. Anderson DI Magill RA, Sekiya H (2001) Motor learning as a function of KR schedule and characteristics of task-intrinsic feedback. J Mot Behav 33: 59-66.
18. Salmoni AW, Schmidt RA, Walter CB (1984) Knowledge of results and motor learning: a review and critical reappraisal. Psychol Bull 95: 355-386.
19. Tomporowski PD (2003) Effects of acute bouts of exercise on cognition. Acta Psychol (Amst) 112: 297-324.