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Old Age and the Brain

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ABSTRACT

As the years pass on, changes come and generate profits and losses of all kinds. So, aging cannot be considered as just a decadence stage.

Therefore, it is important to present myths and realities related to the brain, memory, and capacity of keeping active. To understand these aspects, neuroscience research in the 21st century has been an excellent contribution.

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I. INTRODUCTION

"All that you cannot use will be atrophied" This is a saying in Venezuela that reflects the reality of aging and its cognitive harm; this is also the beginning of the principles of the new vision for studying aging.

1.1 Changing Paradigms

The study of the brain was, for a long time, marked by the belief that the central nervous system has an unchangeable and irreparable structure, either functional and anatomically; this system was conceived as finished and definitive, subjected to a wasting process as well of involution as years pass on, without any repair possibilities in case of any injury.

Thanks to the current technological developments, the brain's inflexibility as a central Paradigm was overthrown; at the moment as it was considered the existence of its plastic mechanism where the activity of a person changes its neurochemical and cerebral neuroanatomy. So, all this creates a molding and reorganization phenomenon where are strengthened and established new synaptic connections and being weak all the ones that are not frequently used. Currently, such stimulations seem to induce the process of neuronal generation.

The new perception of aging as an individual and social phenomenon with a series of positive aspects helps to block the typical negative stereotypes in front of this life's stage, and this also aids the development of specialized knowledge of great utility in the area to avoid to perceive aging as a synonymous of illness.

1.2 That Great General Manager: Our Brain

The encephalon has two hemispheres: left and right; each side has different attributes, and both of them make our functions integrated. The "Cold & Analytical" Brain seems to be on the left side, whereas the "bohemian & creative" brain in the right. It has been said that it has an approximate weight of 1.5 Kg (33.06 pounds) shaped by nervous cells called: neurons and neuroglia.

The external layer of the brain, or cerebral cortex, has a similar size to a napkin with a thickness of half dozens of a deck of cards (Punset,2006). It is organized hierarchically among the layers that constitute it, where the superior's layers are related with the tailor of new situations as well events predictions while the inferior's layers are associated with basic activities.

In all this neuronal dynamical exists electrical and chemical components that arise in the contact among the cells it has been named: The "Nervous kiss" the impulse passing that it has been nominated: Synapsis. The substance's liberation or neurotransmitters occurs due to chemical synapsis, henceforth blisters, in encapsulated forms, in an element that requires the organism in a specific moment.

1.3 The Time in the Brain

Calero & Navarro (2006) affirms that, until a certain age, the cognitive functioning is being

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stimulated by the rhythm of life of each person, Still, when old-age arrives, and there are nothingness environment's demands, it begins a process of "in-activity" that ends, at least, as a response of the decline produced in this stage of life.

Cohen (quoted by Escobar, 2001) defines brain's aging as the loss, severe or chronic, of the adaptation capacity to any change, being necessary for optimum relationship life.

It would be very unrealistic to assume that aging is exempt from changes in the brain, among them and the most important, the selective neuronal death's that occur in certain cortical areas, as well the reduction of the neuron's size. Based on that, it will explain the theory exposed by Svennerholm et al. (Quoted by Alvarez, I et al., 2002) that affirms: when a brain arrives at 100 years, its weight is reduced among 20% in women and 22% in men.

Different studies on the area have the tendency to emphasize the neuron's losses in the neocortical associative areas and the archicortex (Hippocampus and Dentate Gyrus).

In general, men lose - before and in a much higher quantity - cerebral tissue during aging than women. They are more susceptible to losing tissue on the frontal lobe and temporal lobe, and the women in the Hippocampus and the Septal Area (Carter quoted by Duque-Parra, 2003).

Furthermore, the encephalic's blood flow is reduced on 20%.

The evidence is increasing and point out the fact that both sides of the brain become older differently; the effects of aging in the brain generate atrophy that would affects the right hemisphere – responsible for learning new things – usually much faster compared with the left's hemisphere – linked with known situations -. The neurotransmitters altered are the acetylcholinergicus of cortical projection, that means acetylcholine; the nigrostriatal pathway is a bilateral dopaminergic pathway (Dopamine), and the noradrenergic of cortical projection (noradrenaline). Other neurotransmitters seem not suffer substantial disorders, like glutamate, the key neurotransmitter excitatory linked for learning ability.

The disorders in the equilibrium of noradrenaline and serotonin create condition of the sleep-wake cycle, one of the mains complaints of older adults.

Equally, the reduction of noradrenergic effects in memory disorders and paradoxid dreams, as well the functions associated with the frontal lobe that cause distractibility due to irrelevant stimulus. (Román y Sanzhez-Navarro, 1998).

Neuropsychologically, regular brain aging is being characterized due to cognitive changes fuzzy with very few disabilities that are more marked in memory, thinking & reasoning speed (Petersen et al., Zec quoted by García-Sanchez and Estévez-González, 2002).

1.4 Good News for Aged Brain

In front of the changes of the number of neurons, it is being activated compensatory systems - biochemical level - through the production of neurotransmitters by the unscathed neurons; and - morphological level - the increase of dendrite's tree of intact neurons as well the production of new neurons.

The modern study of neuroplasticity shows the brains of older adults are not degenerated; it just shows a particular evolution according to the, life's activity that they have performed.

In this way, it is confirmed the Hebb's Prediction, the use contributes to the maintenance of synapsis activity (Bauer quoted by Redolat & Carrasco, 1998) because the enriched experience seems to produce positive changes on cerebrum neurochemistry and its neuroanatomy, with the grow of cortical thickness, neuronal ramification and synapsis increase.

The Neurogenesis an adult's brain is verified with the production of new neurons in the olfactory bulb and hippocampus. it shows a great relevance in all the cases where, since significant neuronal deaths, it's possible to induce encephalon to substitute the neuron's loss (Kolb and Whishaw, 2006).

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Inside on this new neuroscience's perspective, it is being considered that neurons and glial cells are keeping reproducing during all its organism's life in the olfactory bulb and hippocampus. However, it is being unknown the functionality of the new neurons, as well is not totally accepted the neocortex's regeneration.

The Brain, due to its plastic ability, changes in the response to its environmental alterations. It can vary its neurons connections, modify its capillary networks that provide oxygen and nutrients as well to produce new synaptic chains in specific brains areas (Carvallo, quoted by Valbuena., 2008)

1.5 We are Challenging Time's Effect: Brain's Working

All theorists of gerontological science agree that to feel useful and have a strong sense of personal competence is linked to the creation of exciting productive and intellectual activities facilities - positively - the older adults in cortical level as well socially and emotionally.

Therefore, being involved in complex volunteer activities promotes the creation of new neurons, as well positives modifications in neurobiological processes, among them the neuronal activation, improves blood circulation in the brain and the metabolism of glucose and oxygen.

If we analyze the brain's nature - frequently by reason of energy-saving - is not susceptible of changes; so, the "Mental Hygiene or Mental training" promotes changes in daily routine that allows the brain to increase its synaptic circuits and amplify its action ratio, readjusting continuously due to its environment's demands (Carvallo, quoted by Valbuena, 2008).

The production of new neurons and brains modeling can be increased through the mental effort derived from planned cognitive training and appropriated needs of aging people, being understood as the learning & Re-learning process.

Its execution among this kind of programs and the response of the activities proposed are intimately linked with its educational level (Cultural) - it has been demonstrated as a significant protective factor of neurodegenerative illness because it promotes the activity of the complex synaptic network, and in front any alteration, it exists alternate basics synaptic interconnections that helps to comply with the needed function -. It is had been known as Cognitive Reserve; even though it has not any subjacent histopathological process, it is involved at the level where are expressed the expected clinical disturbances occur.

Factors like learning, practice, and constant repetition are activities that seem to be associated not only with the development of new neurons but also health care, functionality, and extension of lifetime expectation. (Instituto Nacional de Salud Mental quoted by Araya y Camargo, 2003).

Each time is being more accepted the idea that education provides a protective effect against cognitive disorders and also it is also an imperative indicator element that helps to predict the cognitive strength in late maturity. It seems that it is not education by itself. Still, it is the nature of the associated activities with advanced education that protects against the incidence of cognitive disorders (Albert et al., quoted by Goldberg, 2002).

According to Stern et al. (2004), during the normal aging process could exist a neuronal reorganization of the cognitive reserve, that belongs to a compensation process, due to neural consequences of aging in different forms in the brain areas; if we compare it with the development of young adults; the main idea of this proposal is, in few words, to keep active and busy.

So, it is clear that cognitive reserve is something ductile, changeable during life, and depends on other innate factors like experiences obtained, as well as other factors like education, work perform, and leisure activities in the elderly stage.

Leisure activities also have and fundamental role in the maintenance of cognitive functions because a lifestyle characterized by entertainment of social nature is associated with a lower intellectual decline and development of a new synaptic

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network more efficient that provides a cognitive reserve that delays the clinical results of neurodegenerative pathology.

Thus, in the way the brain is being used all your life, it will influence the quantity of your available cognitive reserve.

1.6 Towards an Active Aging

The scientific research suggests a "bimodal" image about aging whereas existing crucial differences among people who lose - through the years - their intellectual functions and those who maintain it (successful aging); So, currently, it can be considered a myth to perceive the path towards aging as an inexorable, predestinated and fatalistic.

Among the factors which play a key role in successful aging, we can highlight health conditions, physical exercises, education, intelligence level, personality, cultural experiences, activity, cognitive training, and lifestyle. Specifically, the related agents with low risk of cognitive decline in the elderly it has to do with the participation in activities that generally are available in complex and intellectually challenging environments (Schaie, quoted by Redolat and Carrasco, 1998).

Findings about of Neuroplasticity, Neurogenesis, quality of life, and neuropsychological advances provides an extensive view about aging because all the activities that make a person are certainly important. After all, the value of mental life with high intensity allows the cognitive well-being on life's advanced stages and impacts directly on its perception of self-efficacy.

A growing number of studies suggest that innate capacities, measured by intelligence quotient at an early age, are being influenced by experiences obtained later, and both factors contribute them to the reserve grade available at the moment we become older adults.

The integrity of cognitive functions and the possibility to reach successful aging will depend on the diversity and characteristics of the activities that will be handled during life; all these will promote structural and functional changes in our brain. Therefore, the challenges are essential for our brain.

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