DOI: 10.38146/BSZ.SPEC.2021.6.8

BOOK REWIEV

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Neuroplasticity
The MIT Essential Knowledge Series

Abstract
As editor Bruce Tidor sets it in the preface of the book, published in the volume of the MIT Essential Knowledge series: *'Synthesizing specialized subject matter for non-specialists and engaging critical topics through fundamentals, each of these compact volumes offers readers a point of access to complex ideas.'* (Costandi, 2016). In this book of the series Moheb Costandi provides the reader with a celar and coherent picture about neuroplasticity and neurogenesis. Not just at the level of theories and research results, but also regarding various stages of practical application. It is equally applicable for average people in areas of everyday life- adult education, lifelong learning, and mental training, too. Costandi's book is decidedly good background material for Anders Hansen's practical book '*The Real Happy Pill: Power Up Your Brain by Moving Your Body'* (Németh, 2021).

Keywords: lifelong learning, adult education, neuroplasticity, brain structure, neurogenesis, mental training

Preface

Moheb Costandi graduated as a neurobiologist and regularly publishes in his field in world-leading journals like New Scientist, Scientific American, Science, and Nature. Head of the Neurophilosophy section of the renowned British Guardian. In addition, Costandi compiled two scientific volumes, the first of them is the 50 Human Brain Ideas You Really Need to Know. I present in this paper his other book entitled Neuroplasticity, which has been published under the auspices of MIT, one of the leading universities in the world. The topicality

of writing the book was given by the fact that works on neuroplasticity appeared as a panacea one after the other. The author systemizes the topic and guides the readers step by step regarding optional areas of use of neuroplasticity.

Another relevance of this topic was given by the new scientific thesis that: *'The adult brain is not only capable of changing, but it does so continuously throughout life, in response to everything we do and every experience we have'* (Costandi, 2016). In today's world, where lifelong learning and development fulfil a key role in people's lives, hence this discovery is of tremendous significance. Worthy of note, even a few decades ago, the scientific world firmly believed that the brain, along with bodily growth, would transform into a rigid structure and not change more substantially.

Review

The book consists of 192 pages, nine chapters, built in a coherent way from the historical background of neuroplasticity to the increasingly accurate mapping of the brain. The author illustrates the exercises required to preserve the abilities of the adult brain. One of the most significant statements is: *'Neuroplasticity can be seen in various forms at every level of nervous system organization, from the lowest levels of molecular activity to the highest level of brain-wide systems and behavior.'* Two main groups can be distinguished: structural and functional neuroplasticity. In the former one, the strength of the connections between neurons changes. While in the latter one, are continuous changes in synapses due to learning and development.

Summary of the chapters

In the introduction chapter, we can obtain an overview of the concepts of neuroplasticity and neurogenesis. And we can receive insight of the history of the concepts: *'In the early 1780s, correspondences between the Swiss naturalist Charles Bonnet and the Italian anatomist Michele Vincenzo Malacarne discuss the possibility that mental exercise can lead to brain growth, and mention various ways to test the idea experimentally.'* In the second half of the twentieth century, a revolutionary paradigm shift took place in the research of the cell formation of the adult brain. According to the new approach, we distinguish between two primary types of neuroplasticity: functional and structural neuroplasticity.

In the second chapter, we will learn about the functions associated with specific areas of the brain. Formerly, these specific areas were believed to be able to supply only one function of the brain. *'Research shows the cerebral cortex is very malleable because certain areas are able to perform different functions: Early evidence that this localization of brain function was not fixed came from studies by Paul Bach-y-Rita in the late 1960s, who is a tool that allowed blind people to 'see' with their touch.'*

In the third chapter of the book, he presents developmental plasticity. The brain, especially in the postnatal years, continuously develops the connections between neurons located in individual brain areas. It constantly produces more cells than its needs, some of them build in and some of them are dismantled. It soon became clear that extensive cell death is a normal feature of neural development in all organisms. This process is called programmed cell death. It regulates the size of neuronal populations, the proper spacing and positioning of cells, and the emergence of shape and form, among other functions, and is therefore vital to the proper development of the brain. The fourth unit of the book deals with the modification of the synaptic / synapses of the neuronal junctions. This modification we call synoptical plasticity. In this section, we can also understand the function of brain synapses as well as the operational logic of neurotransmitters.

After a thorough presentation of the background, the author describes the essential point of the book in the fifth chapter. Costandi analyses the recent findings on adult brain neuronal formation. Previously, according to the official scientific position: *'The neural pathways in the adult brain and spinal cord are something fixed, ended, and immutable.'* As a result of research that began in the late 20th century, this idea has now completely changed. *'Major breakthrough came in 1998 with the publication of a landmark study that provided the very first evidence that the human brain also forms new cells throughout life.'* The following chapter is about the possibility of shaping neurons. *'Just as weightlifting leads to an enlargement of muscle tissue, so too can mental training expand the corresponding parts of the brain.'* The author illustrates this phenomenon through a number of examples, from the notable case of London taxi drivers to martial artists and classical musicians. The seventh chapter examines the relationship between brain injury and neuroplasticity. During the post-stroke regeneration period, for non-invasive therapies, such as electromagnetic stimulation, the brain showed surprising plasticity: *'Activating alternative motor pathways that run parallel to the damaged one.'* The eighth chapter sheds light on dysfunctional projections of neuroplasticity. In addition to the effective examples until now, it is substantial to mention that the brain's conditioned behavior and the plasticity work not only in one way. Drug addiction demonstrates in the best way that

the reward system of the brain is eliminated and it leads to an unwanted state of dependency. So, if the direction of the process changes, it will perpetually exert a devastating effect on the brain. In the last chapter, the author analyzes lifelong neuroplasticity according to life stages. From the prenatal and postnatal stages through adolescence and young adulthood to the older age groups. It devotes an interesting section to parenting. *'As we get older, most of us experience an age-related decline in mental functions such as attention, learning, memory, and task-switching, but other aspects of cognition – such as memory for facts and figures, and the ability to regulate emotions – can often improve.'*

Summary

In summary, it has presently become an undeniable fact that the human brain is capable to regenerate throughout our lives. Therefore, the human brain is capable of lifelong learning with proper physical conditioning. *'Far from being fixed, the brain is a highly dynamic structure, which undergoes significant change, not only as it develops, but also throughout the entire lifespan.'* The book illustrates all of this with a number of excellent relevant examples and research findings. I recommend this book to all leaders and educators dealing with training and education.

References

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Reference of the article according to APA regulation

Németh, V. (2021). Neuroplasticity. *Belügyi Szemle, 69*(SI5), 124-127. https://doi.org/10.38146/BSZ.SPEC.2021.6.8