

BOOK REVIEW

Identification of Neural Markers Accompanying Memory

Edited by Alfredo Meneses

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Memory is the scribe of the soul wrote Aristotle. A major focus of modern neuroscience is to determine the molecular substrates of memory formation and to understand how the scribe captures the uniqueness and essence of life events. Significant progress contributing to this understanding has been made through dissecting conditions associated with cognitive deterioration like Alzheimer's and aging. These conditions provide us with a map of pharmacological targets for manipulation as well as a map to delineate neural pathways involved in cognitive processing of sensory information.

The book edited by Alfredo Meneses titled *Identification of Neural Markers Accompanying Memory* delivers concise up-to-date information for students in neuroscience with clearly demarcated chapters authored by experts in their respective fields (authors for each chapter appear in parentheses). The book chapters are logically organized starting from a brief introduction (Chapter 1 by Alfredo Meneses) to a general overview of each important neurotransmission system (Chapter 2 by Alfredo Meneses) including recent discoveries made using pharmacological agents to activate or repress specific transmission systems. Also included is the association of each system with pathological situations like Down's syndrome, Parkinson's and Alzheimer's disease to promote a further understanding of the importance of these systems in deteriorating cognitive disorders.

Chapter 3 (by Antonella Gasbarri and Assunta Pompili) deals exclusively with the important role played by the amino acid GABA (γ -aminobutyric acid) in memory processes. GABA which is present in high concentrations in the CNS is the chief inhibitory neurotransmitter in the brain. Ionotropic GABA_A receptors are involved in processes that employ rapid synaptic inhibition such as in the regulation of vigilance and anxiety. Agonists of GABA_A decrease memory function while blockers of GABA_A enhance memory function. Metabotropic GABA_B receptors modulate processes involved in the cerebral reward pathway which has potential implications in drug development. GABA_B positive modulators thus are a class of therapeutic agents that can be employed for the inhibition of reward pathways that reinforce dependence to addictive drugs like ethanol, nicotine, and opiates. The chapter also briefly discusses the involvement of GABA in spatial and fear memory – a fact that has impetus for drug development to treat anxiety disorders like PTSD.

The next chapter, by the same authors as previous chapter, discusses the key role played by glutamate for driving excitatory neuronal pathways connecting main cerebral regions. The chapter delves into pertinent details

about the different types of glutamate receptors, the important roles played by each in different aspects of learning and memory related processes, including addiction and the possible avenues for potential drug development to treat nervous system disorders. Special emphasis on this chapter is placed on NMDA receptors labeled here as the 'classic learning and memory receptors' given their essential role in cognitive processes and hence an important target for cognitive enhancement (Collingridge et al., 2013).

Chapter 5 (by Ryan T. LaLumiere), informs the reader about the connection between dopamine and memory. Through anatomical, pharmacological and behavioral studies it is made clear here that dopamine is a crucial modulator of neural plasticity. This function of dopamine suggests novel therapeutic development for dysfunctional habit learning through reward expectation. The main focus of the next chapter (by Michael R. Hunsaker), is an overview of the attribute model which allows the researcher to logically choose behavioral paradigms for the study of animal models of genetic diseases based on experimentally defined attributes (for example spatial and temporal attributes). The author calls for increased interaction between clinical research laboratories and behavioral genetics labs to develop an exhaustive 'behavioral endophenotype' of the mouse model where the mouse is systematically tested across experimental paradigms designed to comprehensively test cognitive domain functions affected in the test population.

Chapter 7 (by Roberto Agustin Prado-Alcala and colleagues) challenges the consolidation hypothesis. This traditional hypothesis is based on the premise that formation of long-lasting memories is through 'consolidation' over time from short term memory and is dependent on protein synthesis. The author presents several lines of evidences to cast doubt on the validity and the broad applicability of consolidation mediated by protein synthesis.

Signal transduction systems are ubiquitous across several phylogenetic groups and the next chapter (by Claudia Gonzalez-Espinosa and Fabiola Guzman-Mejia) introduces the reader to components and concepts of signal transduction cascades in neuronal transmission of information that underlie processes in learning and memory.

Chapter 9 (by Gabriela Rodriguez-Manzo and Ana Canseco-Alba) explores learning and memory in the context of an innate rewarding behavior – sexual activity. Through discussion of recent behavioral experiments, the authors conclude that even innate behaviors, previously

thought to be non-plastic or hardwired, can be tuned by external cues from the environment which are critical for the survival of the organism.

Diabetes mellitus affects about 5% of the population worldwide (Whitmer, 2007) and the final chapter (Chapter 10 by Gustavo Liy-Salmeron and Shely Azrad) discusses the importance of insulin signaling in the brain. On a brighter note, the authors briefly describe research that promotes caffeine as a strong candidate to ameliorate diabetes-induced neurodegeneration.

Overall, the book caters to senior undergraduate students and graduate students who would like an answer to 'What is current in memory research now and where is it headed?' The book also offers a great supplement to standard neuroscience textbooks.

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