



Ben-Gurion University of the Negev

The Jacques Loeb Centre for the History and Philosophy of the Life Sciences

The Molecular Basis of Memory

Chaim Gilon, Institute of Chemistry, The Hebrew
University of Jerusalem

January 15th (Wednesday), Building 39 (Biology),
Room 106 (de Picciotto conference room), 16:15

To date, there is no acceptable molecular explanation for biological memory that emerges from the activity of neural networks. Heretofore, no one has rationalized memory in chemical terms, using physiologic components and operating under the constraints of available metabolic energy. Recently, using existing literature and basic chemical principles, we proposed that the brain's "memory material" resides outside the neurons, in complexes (we call them neutrixes) composed of the neural extracellular matrix (nECM) and dopants (neurometals and neurotransmitters). Memory information is processed by the neuron in a yet-unknown manner. The mechanism we propose is called the *tripartite* mechanism and is shown schematically below.

In the lecture, the tripartite mechanism and its application to emotional memory will be explained. A short overview of the historical development of concepts in modern neurosciences and chemical notation will be presented, as well as a discussion on the similarities and differences between computer and brain.

The Jacques Loeb Centre seminars provide an interdisciplinary forum, in which historians and philosophers of science, as well as scientists, present and discuss new research related to science with a special focus on the life sciences. Case studies and surveys examine the impact of political, socio-economic and personal factors on the conduct of science, the ethics of research, and the causes of progress and setbacks.

Faculty and students from all disciplines are invited!

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Prof. Ute Deichmann, Director

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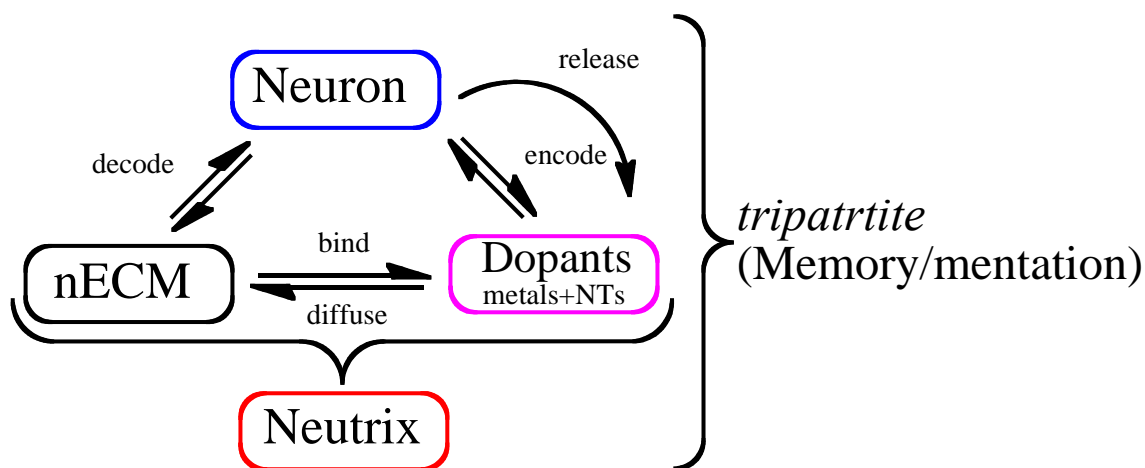


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In support of our theory, we cite a plethora of experimental observations, including: (1) kinetics of the “neural plasticity” mechanism of memory vs. the *tripartite* mechanism (2) correlation of memory loss (forgetting) with inappropriate levels (toxicity/deficiency) of diffusible neuro-metals such as Al, Cu, Fe, Mn, Pb, Zn etc. (3) improper functioning of the neutrix, exemplified by experiments with KO mice lacking tenascins or with immuno-depletion of the metal transporters, metallothioneins (4) correlation between malfunctioning of the neural circuit and memory loss (forgetting), due to neutrix degradation or loss of neural circuit integrity (5) the existence of neurons (especially in the hippocampus) that present splayed, extended shapes with many varicosities, and that display non-synaptic, inter-neural contact throughout the neutrix.



Schematic: The *tripartite* mechanism of memory

Marx, G., & Gilon, C. 2012. [The molecular basis of memory](#). *ACS Chem Neurosci* 3(8): 633-42.

Marx, G., & Gilon, C. Submitted. The Molecular Basis of Memory. Part 3: Tagging with “emotive” neurotransmitters.

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