The brain - condensed neuronal matter, in its comprehensive, coordinated sensory-cognitive functions is the most efficient computer known to humanity. His main role is responsibility for the survival of a living organism, which takes place through the implementation of both innate and acquired programs. Success in the arena of ruthless nature, where there is a constant dance of life and death, is provided to him by the ability to learn and adapt. Humanity undertook the effort to try to understand the mechanisms of learning in the brain by creating various biological models of its components. One of the theories describing the conditions and trying to explain how the learning in the nervous system takes place is the Hebbian theory of synaptic plasticity. According to it, connections between neurons are strengthened, through which the action potential proceeds in accordance with the direction of information flow, while the ones with hindrance direction are weakened. This is the main assumption of a synaptic plasticity model dependent on the relative sequence of impulses occurring in the pre- and post-synaptic neuron (STDP - spike timing dependent plasticity), which is well described by the saying "neurons that fire together, wire together". Fig. 1.

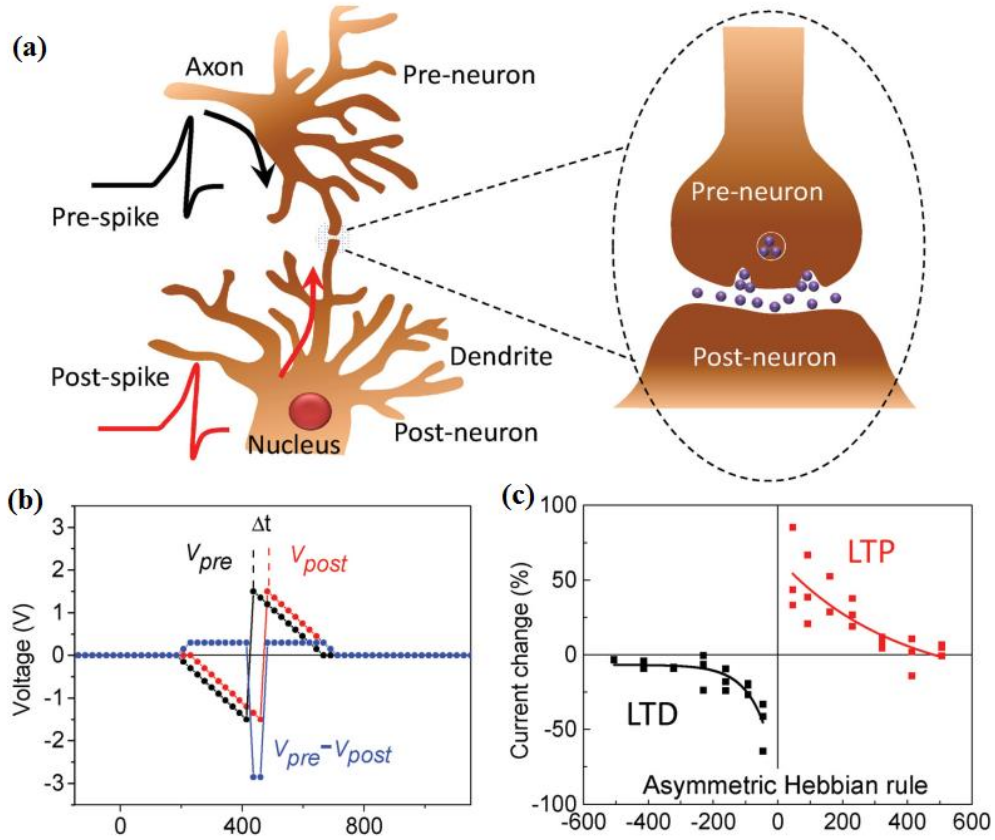

Fig 1. (a) Schematic display of the pre- and postsynaptic neuron together with their action potentials. (b) Electrical signals applied to an exemplary inorganic device exhibiting resistive switching (Au/MAPbI₃/ITO), resulting in (c) Hebbian learning curves for amplification (LTP) and weakening (LTD) of synaptic weights.

The described STDP models can be successfully reproduced in inorganic systems, based for example on the resistive switching phenomena. In this case, we draw inspiration from biological structures to use their advantages for computer applications. Devices in which this phenomenon is observed have two conductivity states - high (ON) and low (OFF), which can be switched electrically. The project assumed the synthesis and research on solid solutions between compounds from the tungstate and molybdate family, in terms of resistive, photo-enchanced resistive switching effects and synaptic properties. Such solid solutions may show non-linear changes in parameters (e.g. absorption coefficient), therefore they should be examined experimentally and determined whether such modifications will improve the performance parameters for modern computational structures.