

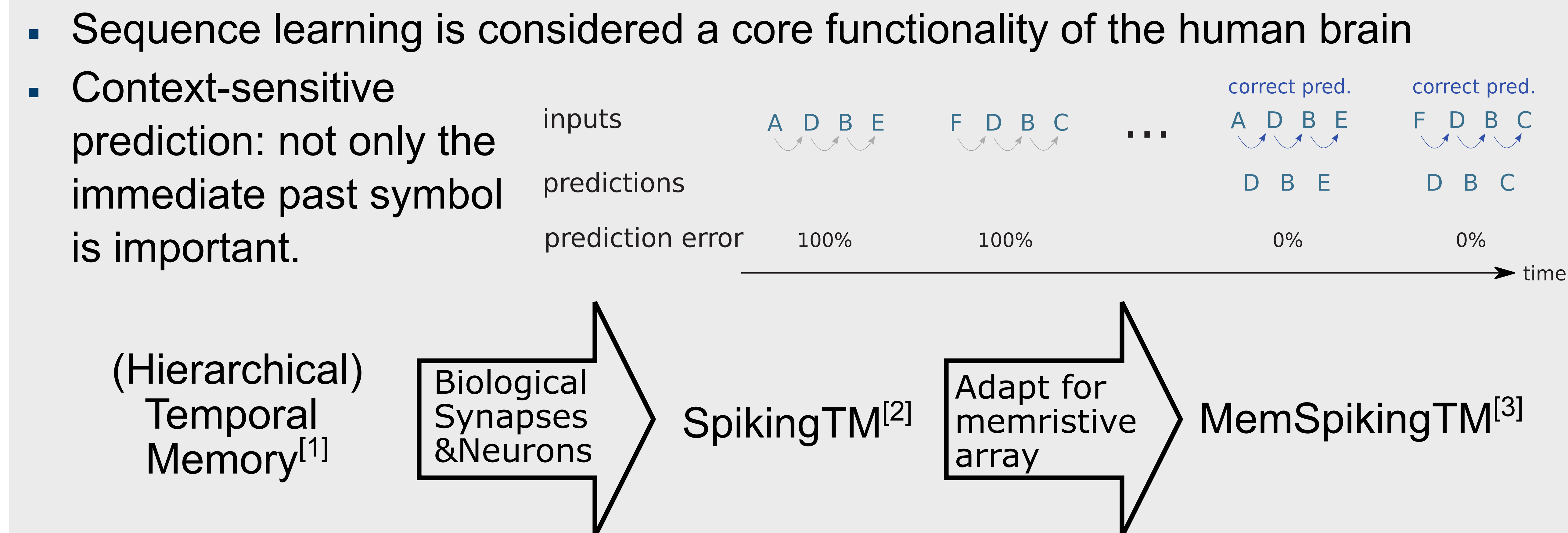
MemSpikingTM

Demonstration of Sequence Learning on a Memristive Array

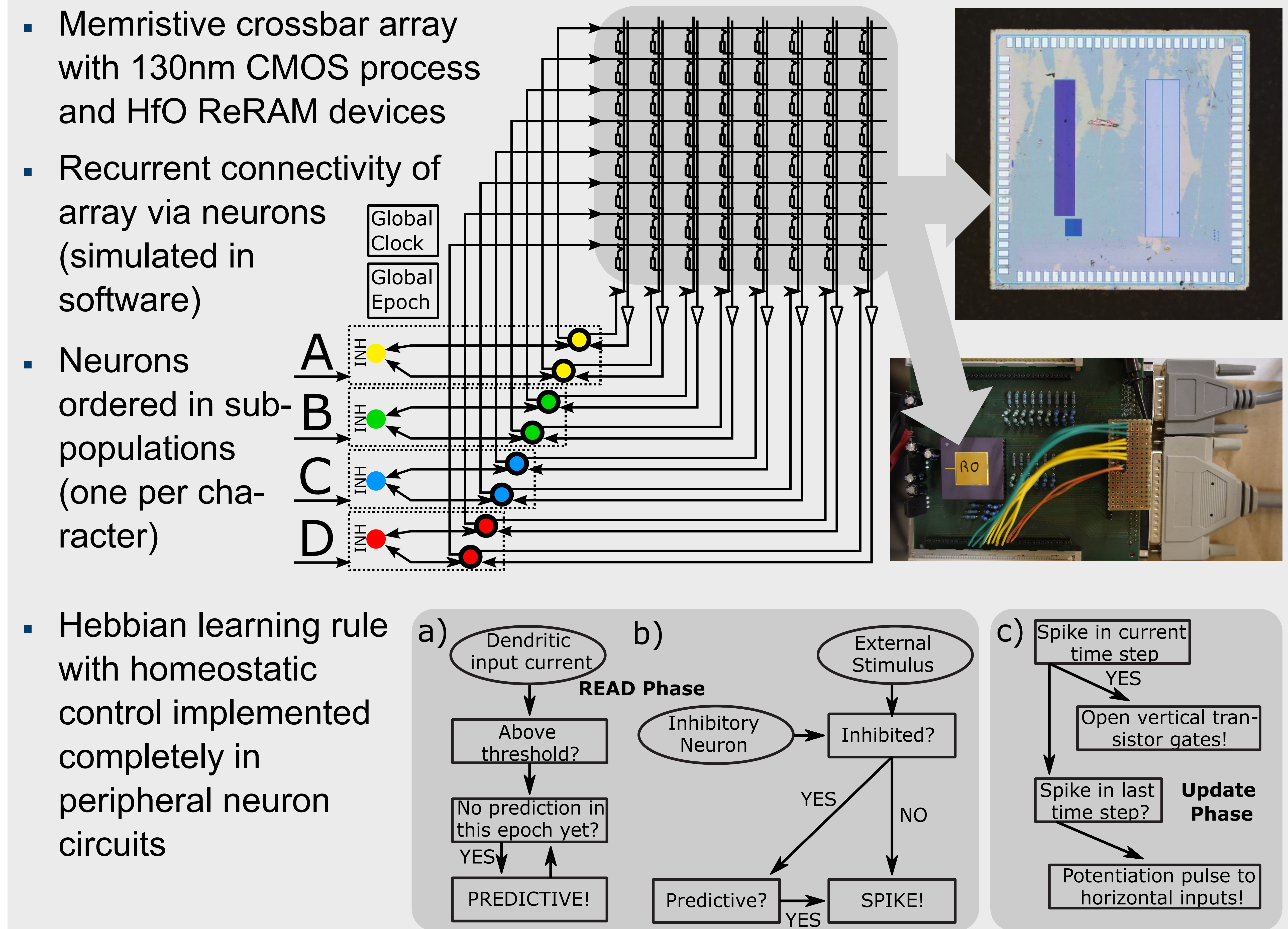
Sebastian Siegel, Tobias Ziegler, Younes Bouhadjar, Tom Tetzlaff, Rainer Waser, Regina Dittmann, and Dirk J. Wouters

PGI-7/10 & INM6/10 - Forschungszentrum Jülich GmbH and IWE2 - RWTH Aachen University

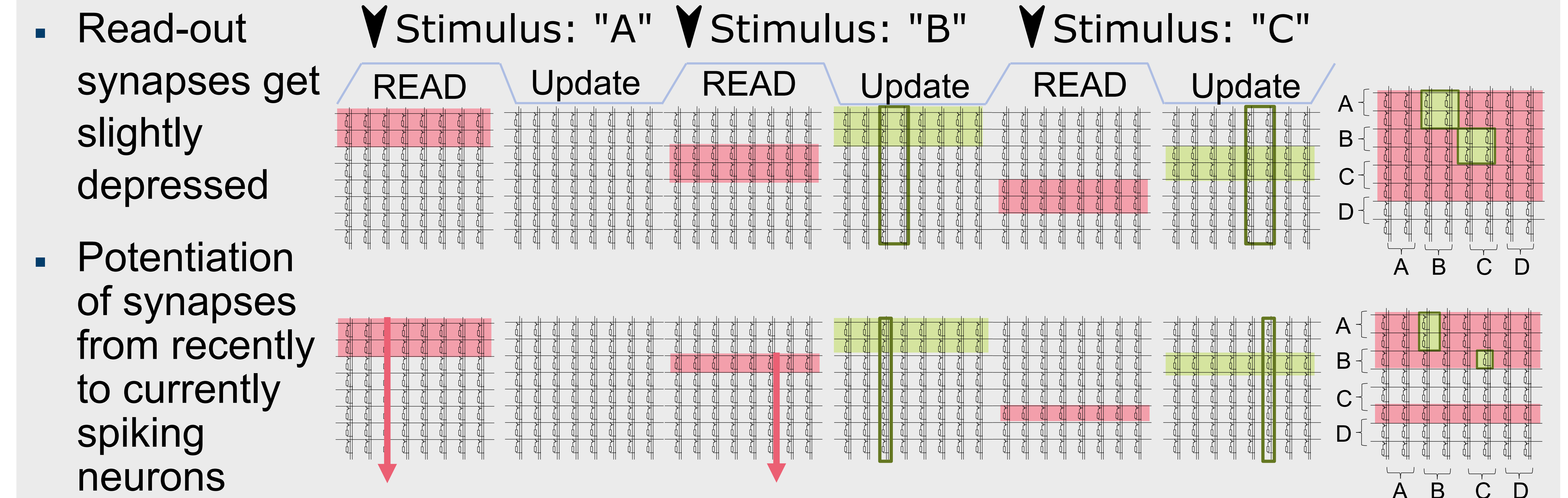
Sequence learning



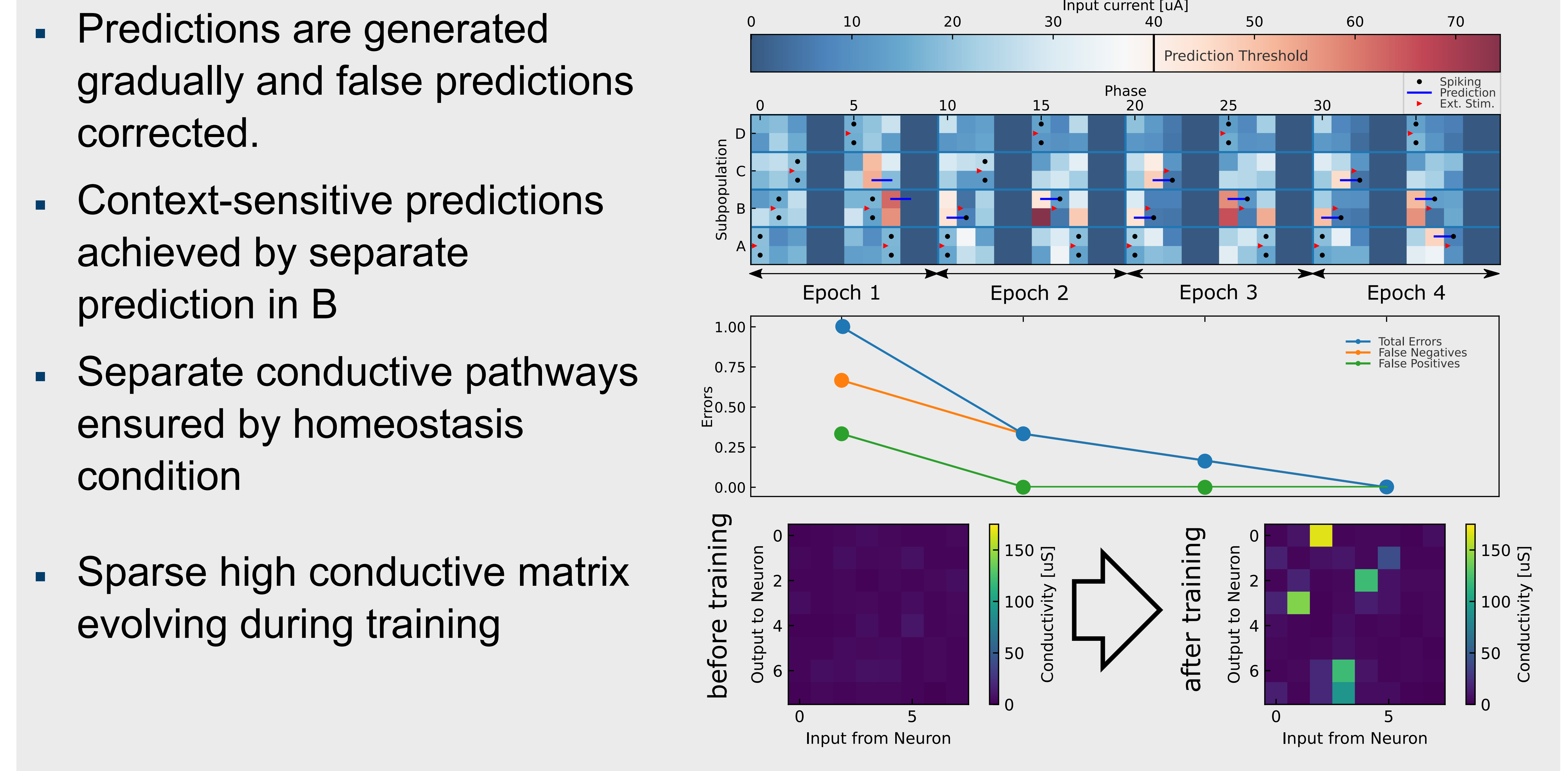
System layout



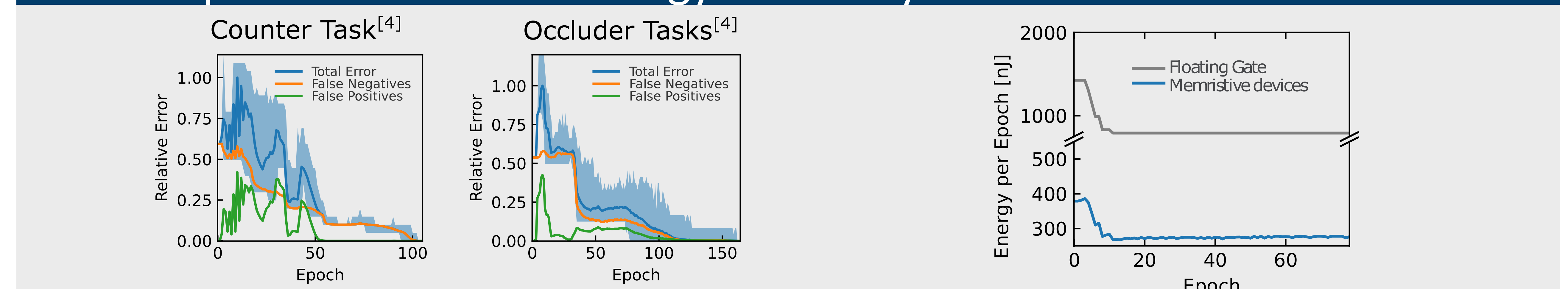
Functional Principles



On-chip High-order Sequence Learning



Scaled-up Simulations and Energy-efficiency



- Sequence learning benchmark tasks solved on 60 neuron system in simulation
- 60% energy savings of memristive over floating gate memory

[1] Hawkins, J., & George, D., "Hierarchical temporal memory: Concepts, theory and terminology". Numenta Inc., (2006).

[2] Bouhadjar, Younes, et al. "Sequence learning, prediction, and replay in networks of spiking neurons." PLOS Computational Biology 18.6 (2022): e1010233.

[3] Siegel et al. "System model of neuromorphic sequence learning on a memristive crossbar array." *Neurom. Comp. and Engin.* (accepted)

[2] Lazar, A., Pipa, G., & Triesch, J. "Spontaneous activity in a self-organizing recurrent network reflects prior learning". *Front. Neurosci. Conference Abstract: Computational and Systems Neuroscience*. (2010)