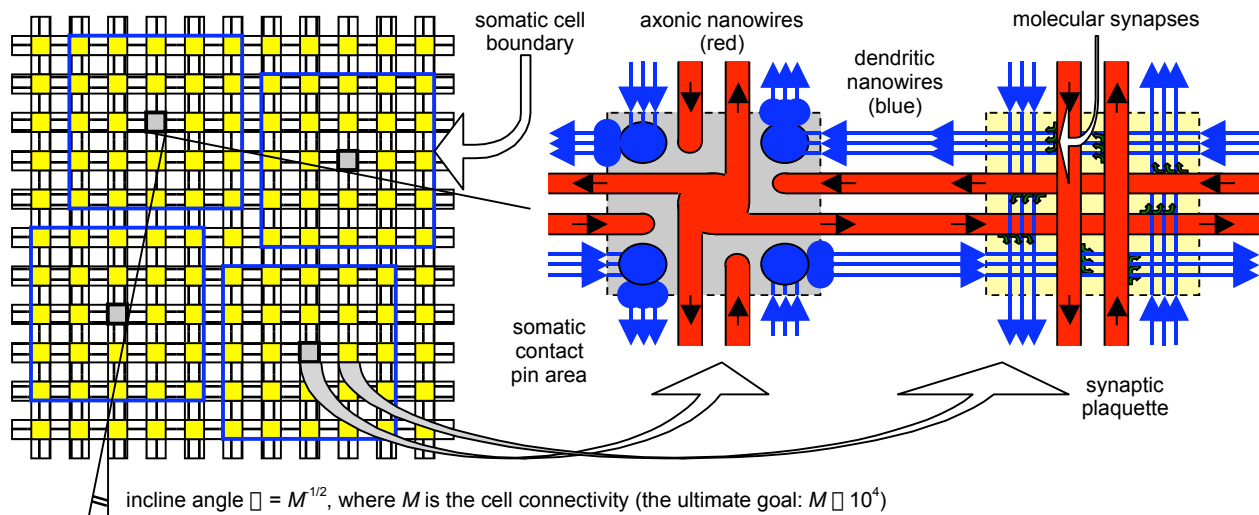


“Nanoscale Single-Electron Switching Arrays for Self-Evolving Neuromorphic Networks”

We have suggested and analyzed a highly effective architecture (“InBarNet”, standing for Incline Crossbar Network) of 2D switching arrays for future self-evolving neuromorphic networks. This architecture allows to combine high density CMOS-based somatic cells (up to 10^8 per cm^2) with extremely high density of single-electron latching switches working as synapses (up to 10^{12} per cm^2) necessary for our “final” goal: placing a hardware analog of a mammal cerebral cortex on a $10 \times 10 \text{ cm}^2$ silicon area.



Estimates show that this architecture, implemented using gold EUV-interference-patterned nanowires and chemically assembled single-molecular synapses, may allow to reduce the average intercell latency below 100 ns, i.e. make the network at least 5 orders of magnitude faster than their biological prototypes, at acceptable power consumption (below 100 W/cm^2). If success along these lines materializes, extremely efficient signal processing may become available, and virtually all spheres of information technology will be significantly impacted. The work on the experimental implementation of nanowires and molecular synapses is in progress.

References

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