The brain in silicon: history, and skepticism

Alessio Plebe
Giorgio Grasso

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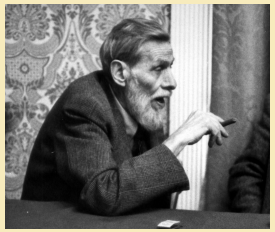
The brain as a logic system

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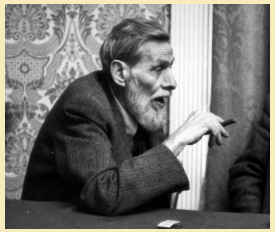

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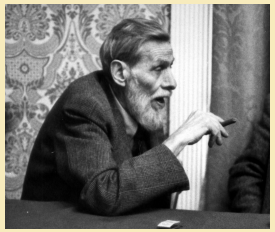

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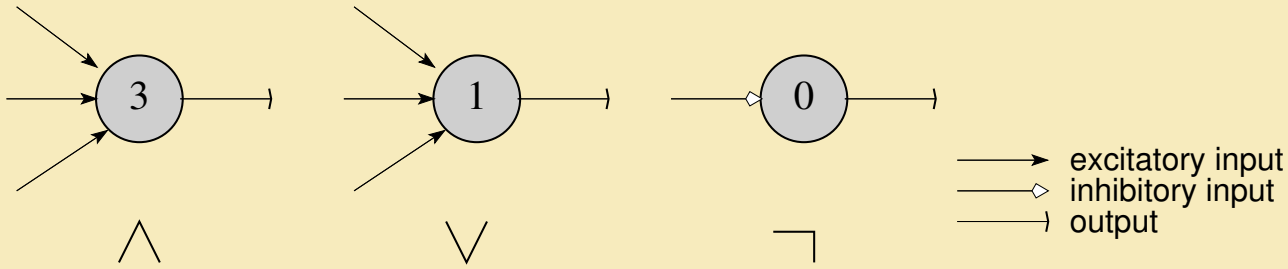

The intuition of Turing

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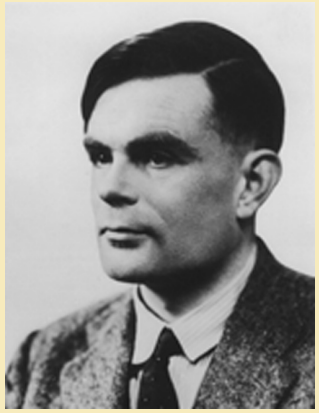

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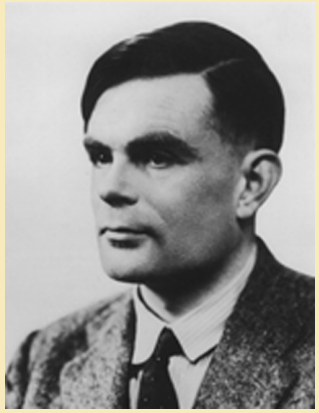

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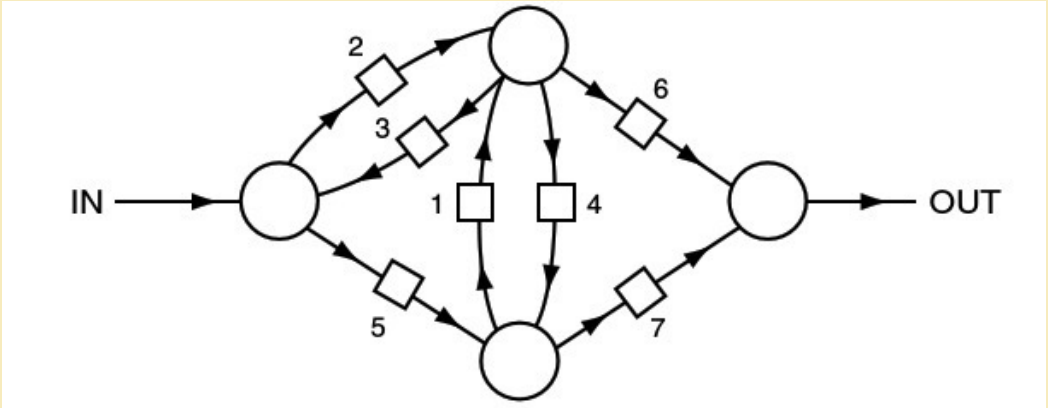

The first neurocomputer

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SNARC (Stochastic Neural Analog Reinforcement Computer)

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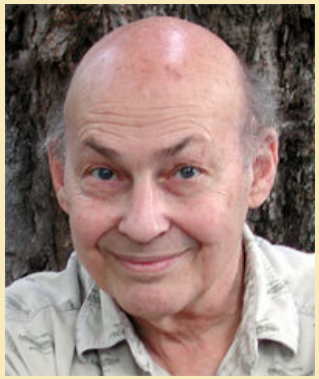

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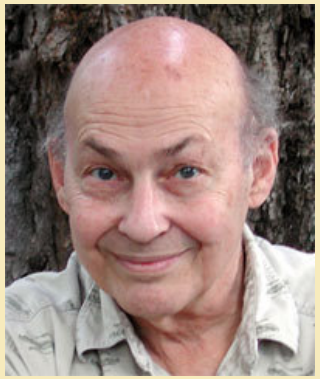

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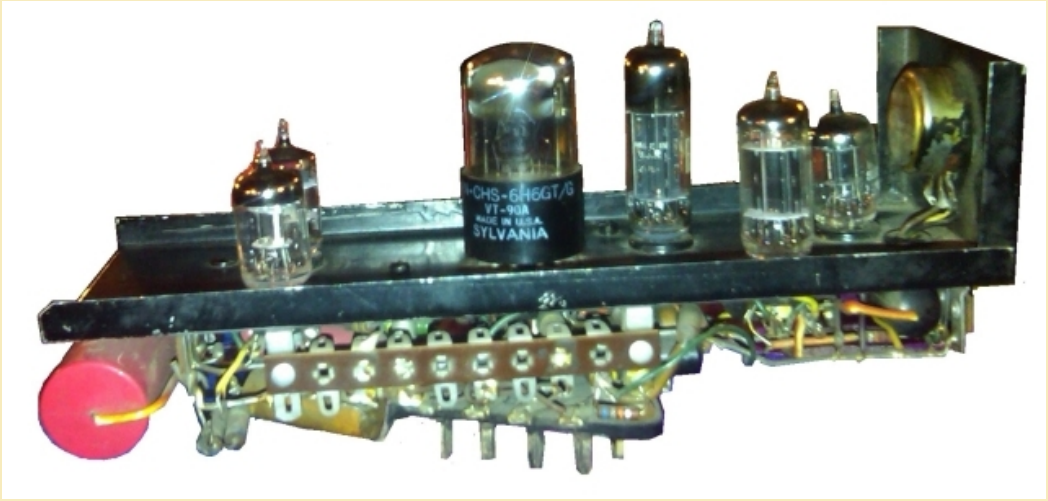

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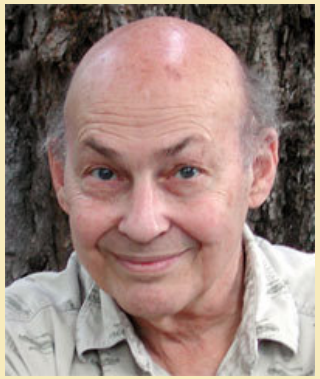

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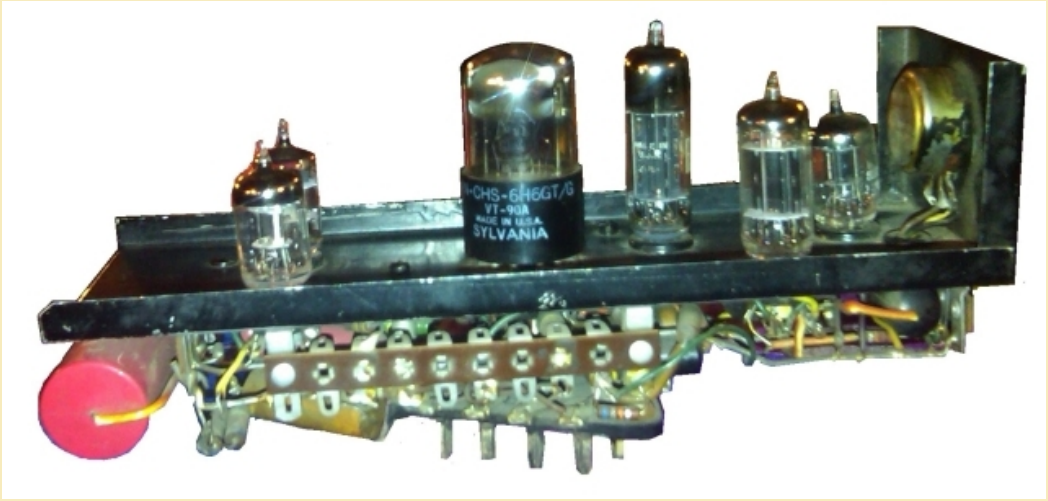

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Disimissal of the brain as computational paradigm

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"The perceptron has shown itself worthy of study despite (and even because of!) its severe limitations. It has many features to attract attention: its linearity; its intriguing learning theorem; its clear paradigmatic simplicity as a kind of parallel computation. There is no reason to suppose that any of these virtues carry over to the many-layered version. Nevertheless, we consider it to be an important research problem to elucidate (or reject) our intuitive judgment that the extension is sterile." [pp.231-232]

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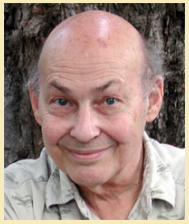

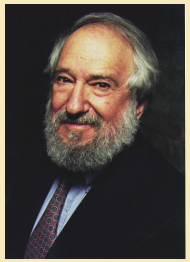

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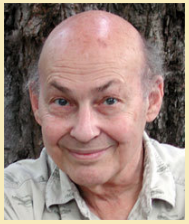

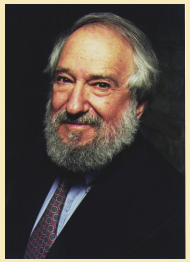

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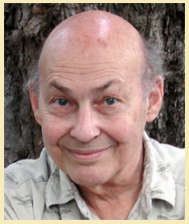

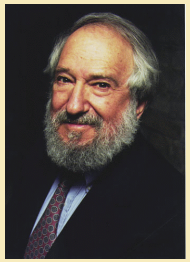

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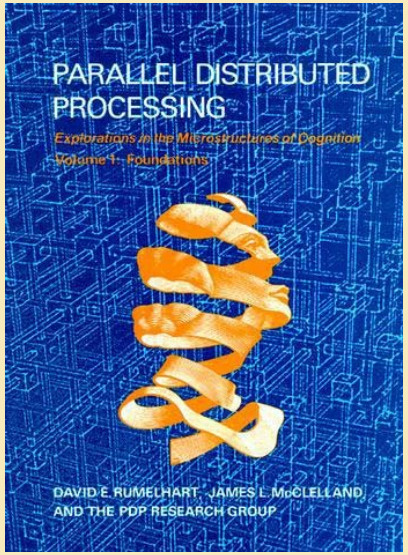
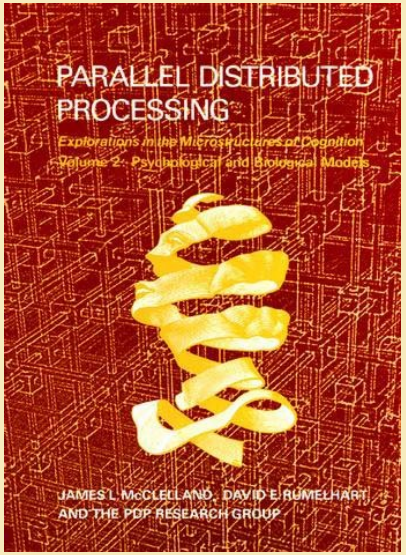
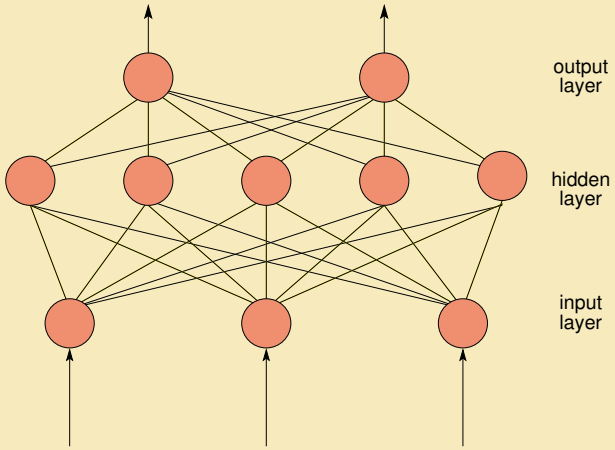




Artificial neural network concept



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x_{i,k} &= h\left(\mathbf{w}_{k,i}\,\vec{x}_{k-1} - \theta_{i,k}\right) \qquad 1 < k < K \\
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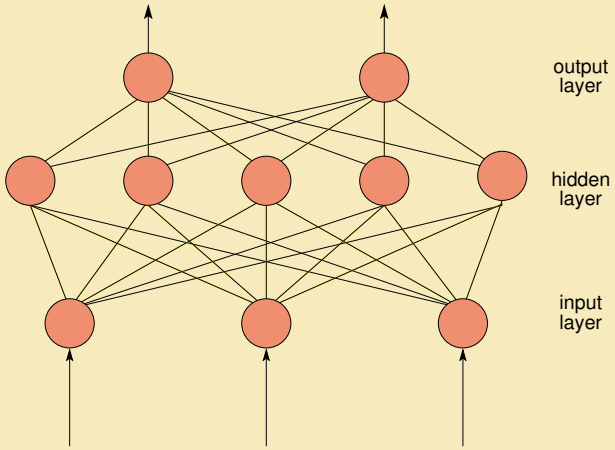

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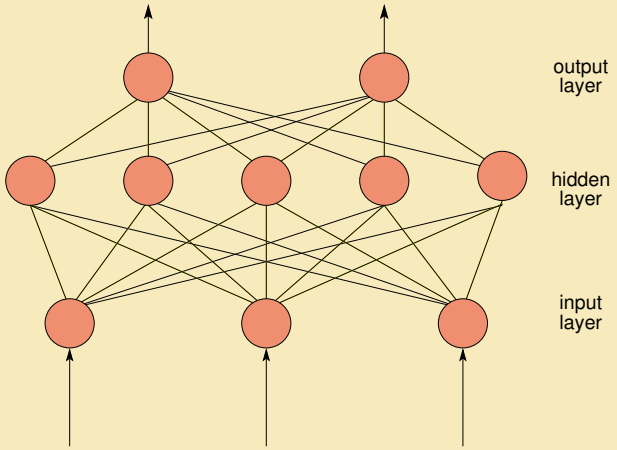

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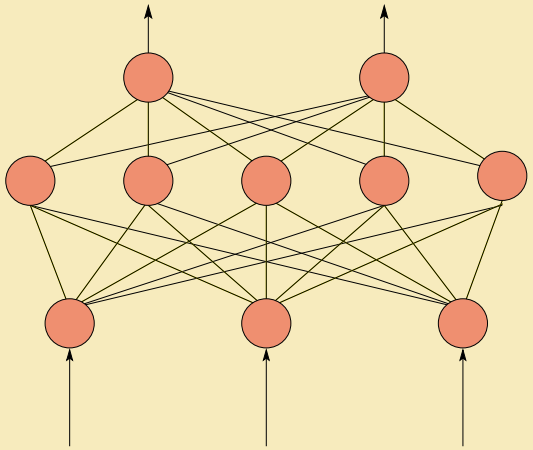

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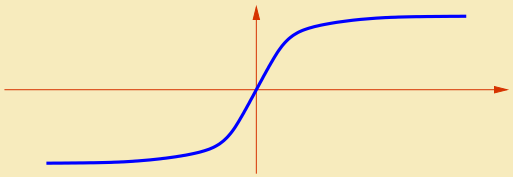

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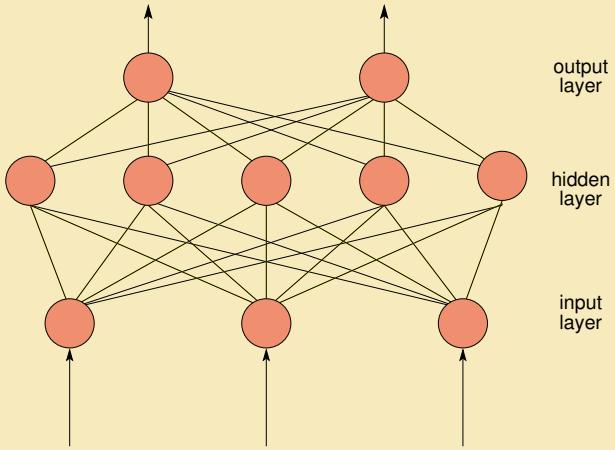

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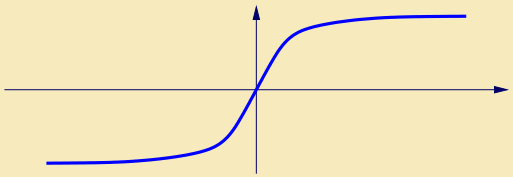

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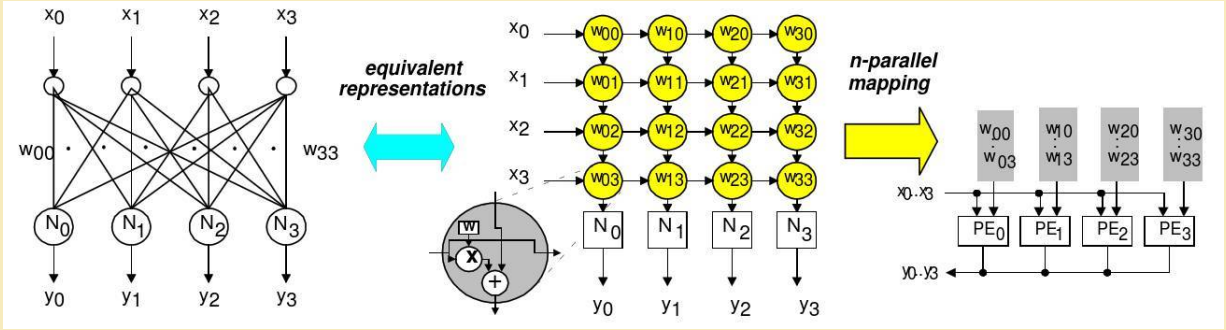

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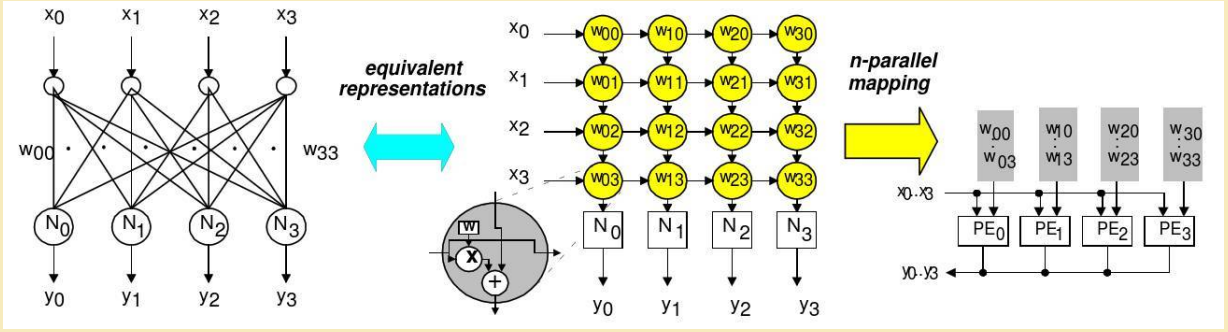

Neural networks in hardware

CNAPS *Connected Network of Adaptive Processors* Adaptive Solutions

SYNAPSE *Synthesis of Neural Algorithms on a Parallel Systolic Engine* Siemens

L-Neuro Philips

SpiNNaker *Spiking Neural Network Architecture* Advanced Processor Technologies

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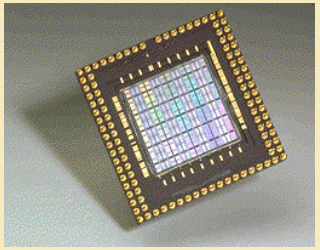

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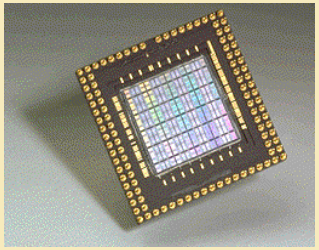

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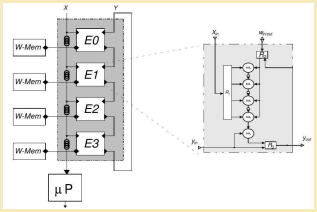

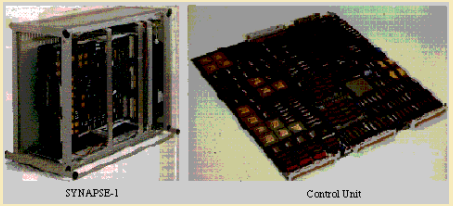

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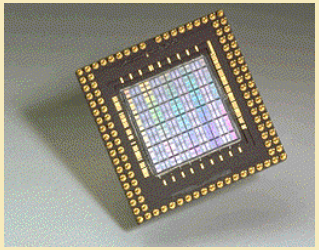

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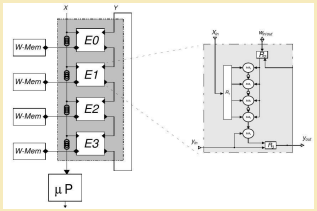

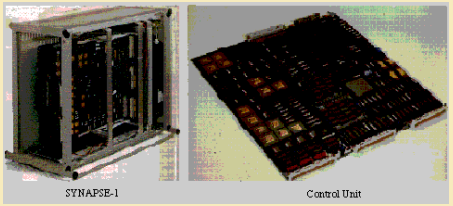

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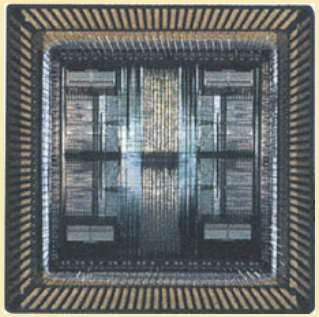

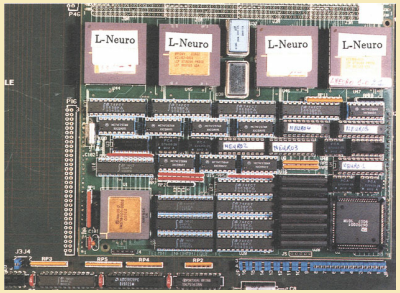

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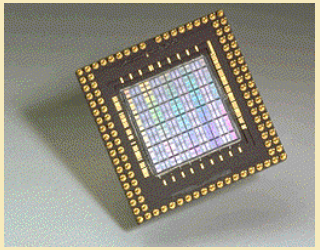

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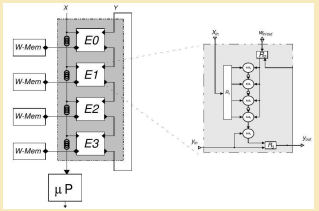
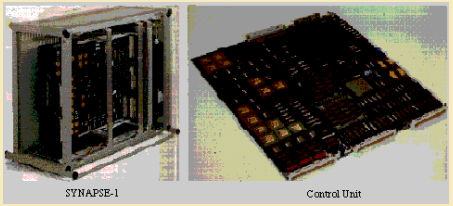
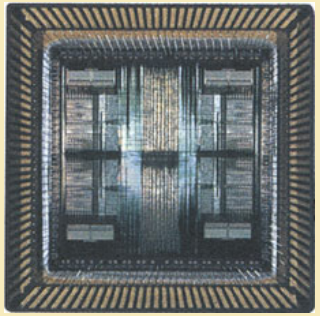
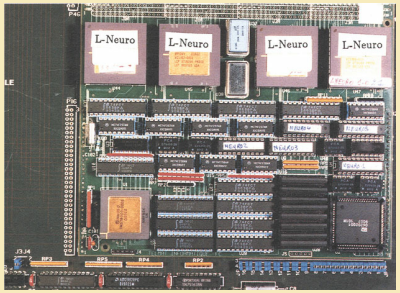


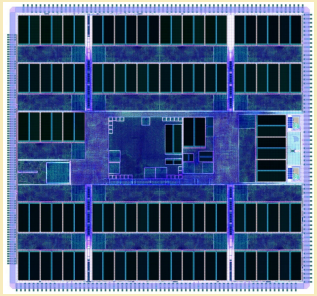


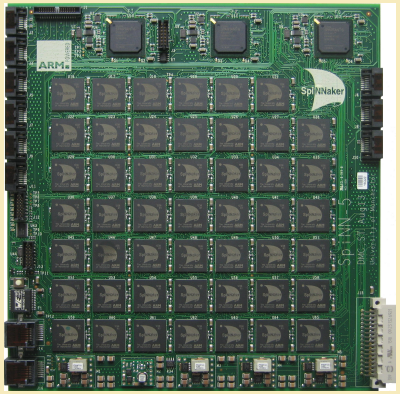
L-Neuro Philips





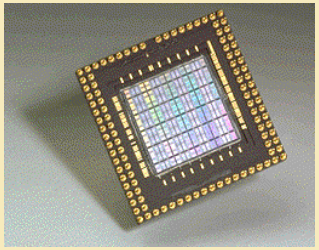
SpiNNaker *Spiking Neural Network Architecture* Advanced Processor Technologies





Neural networks in hardware

CNAPS *Connected Network of Adaptive Processors* Adaptive Solutions



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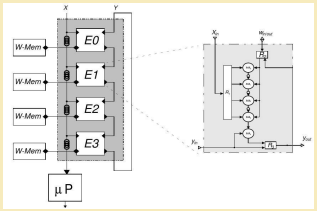

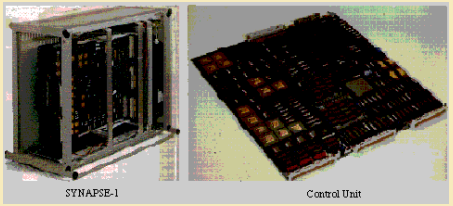

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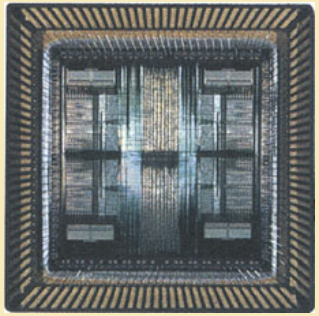

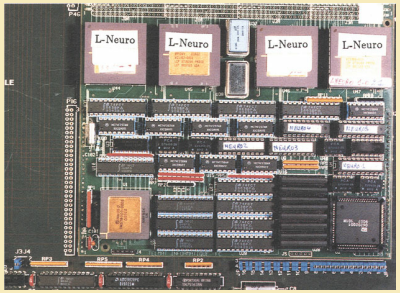

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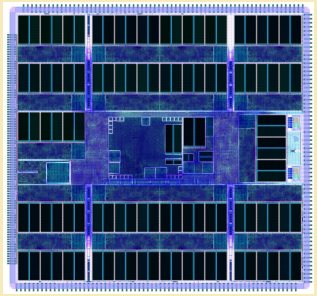

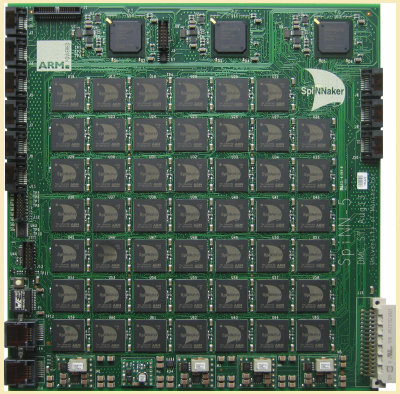

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action potential (spike)

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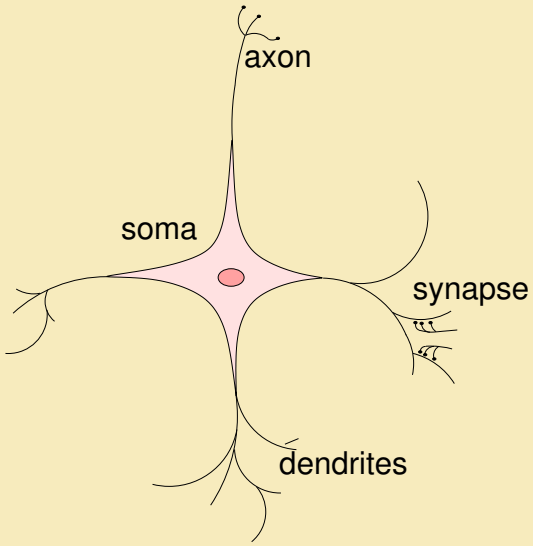

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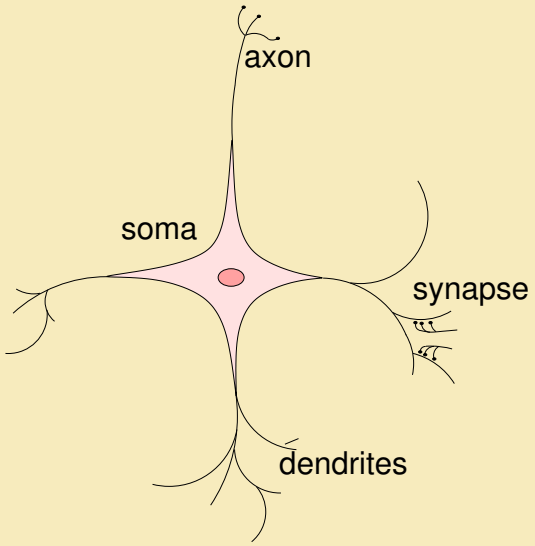

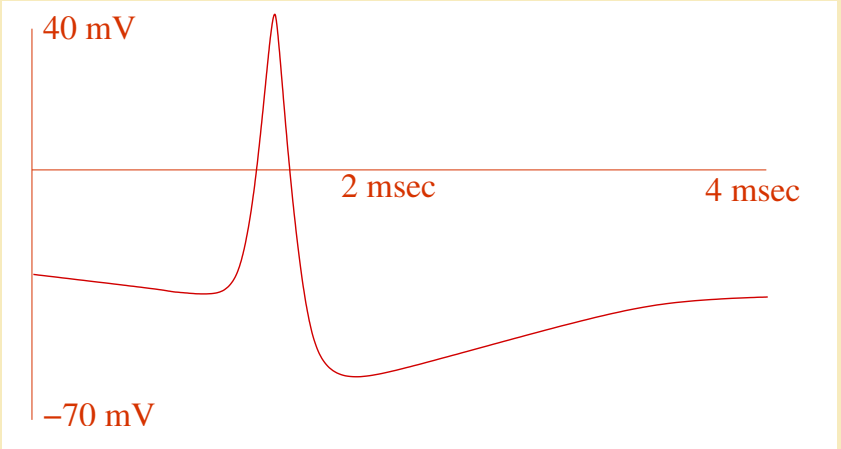

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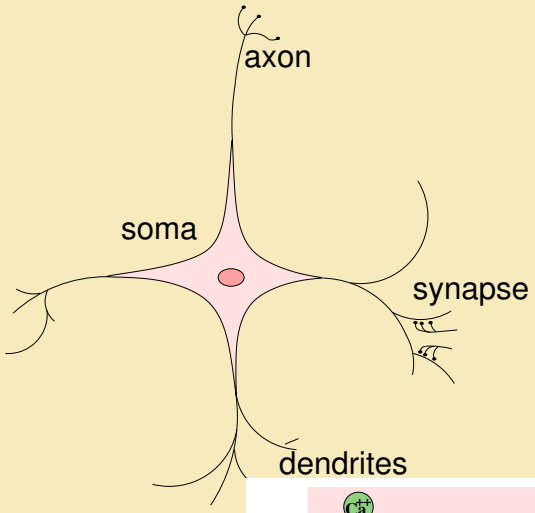
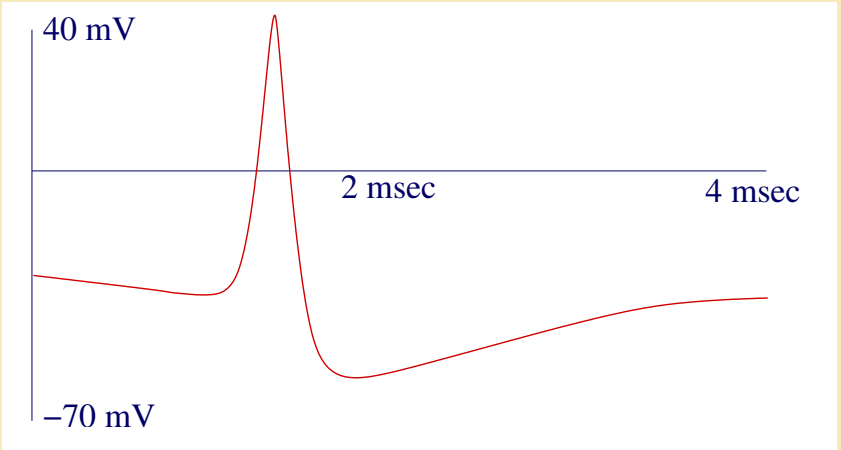
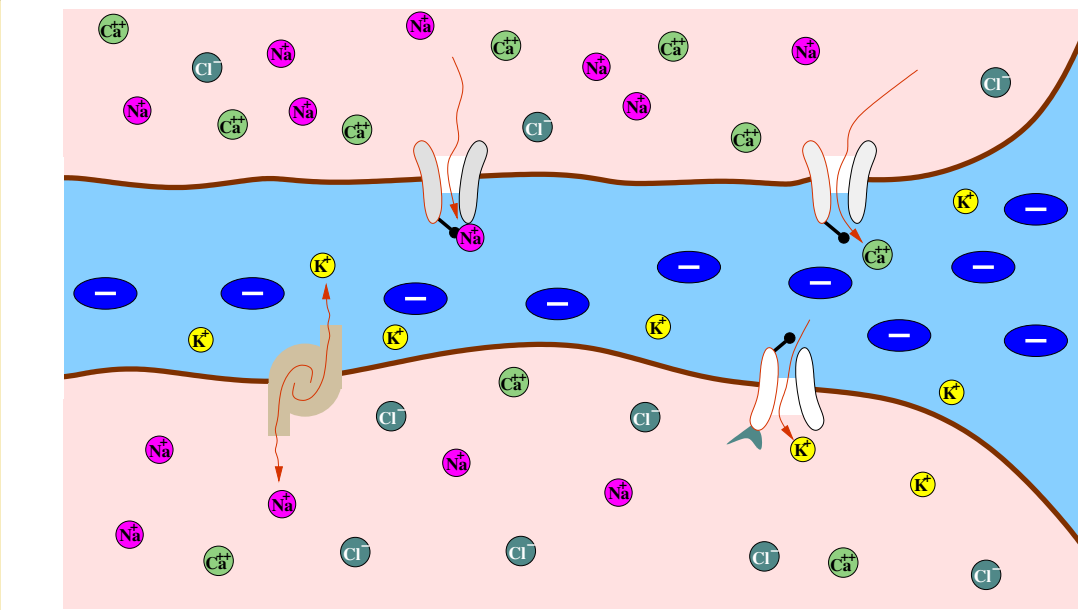
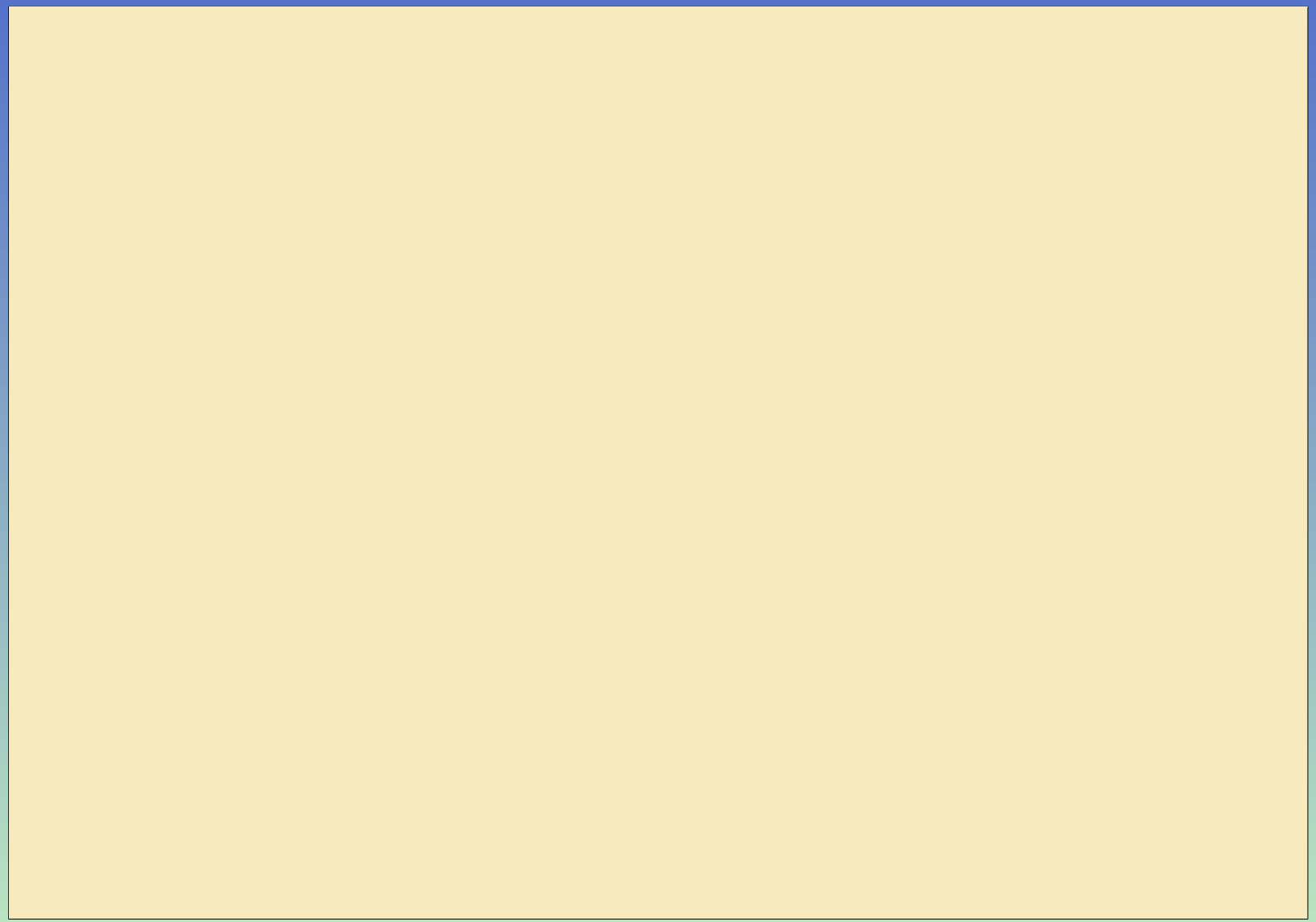






How the neuron get tuned



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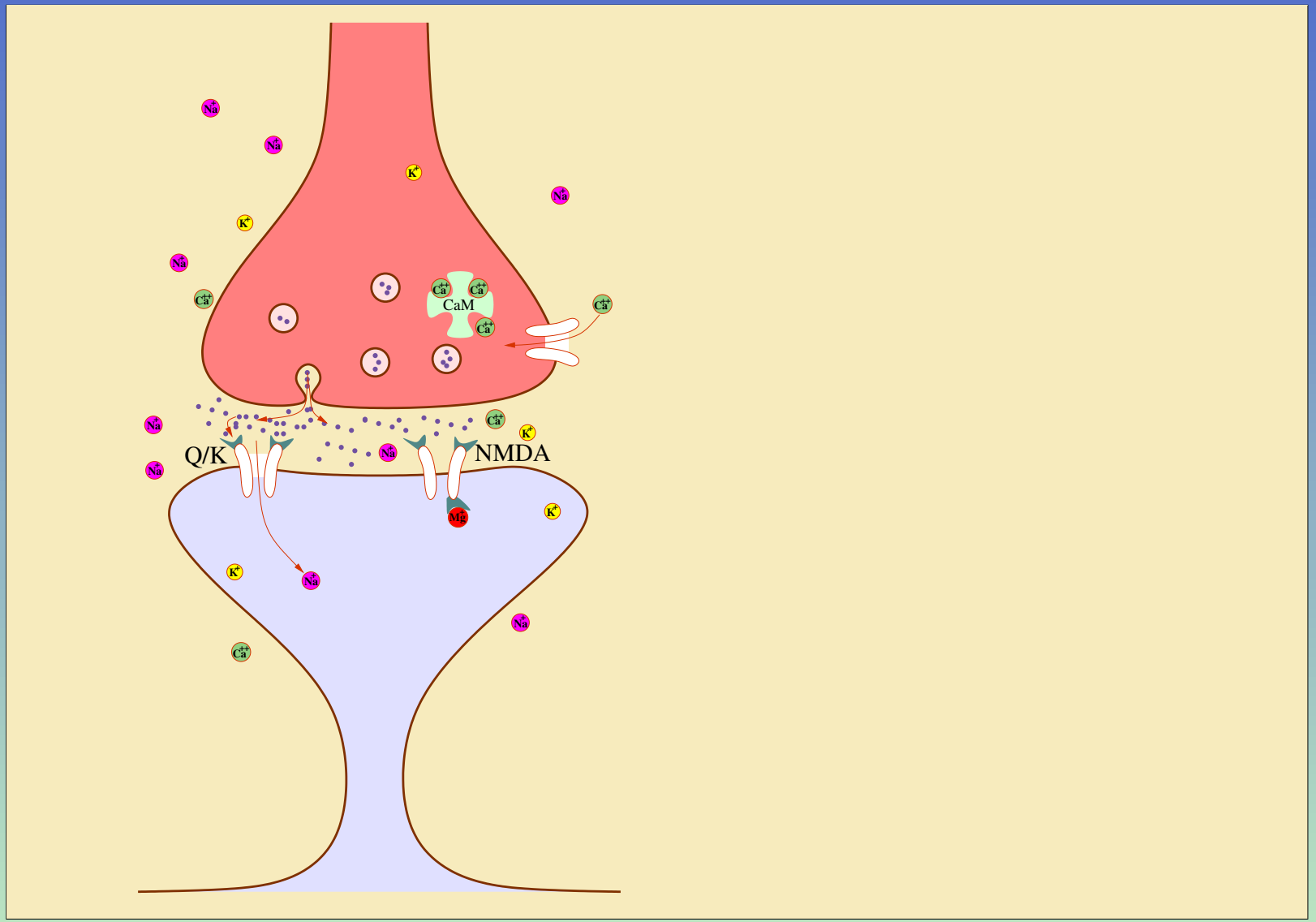

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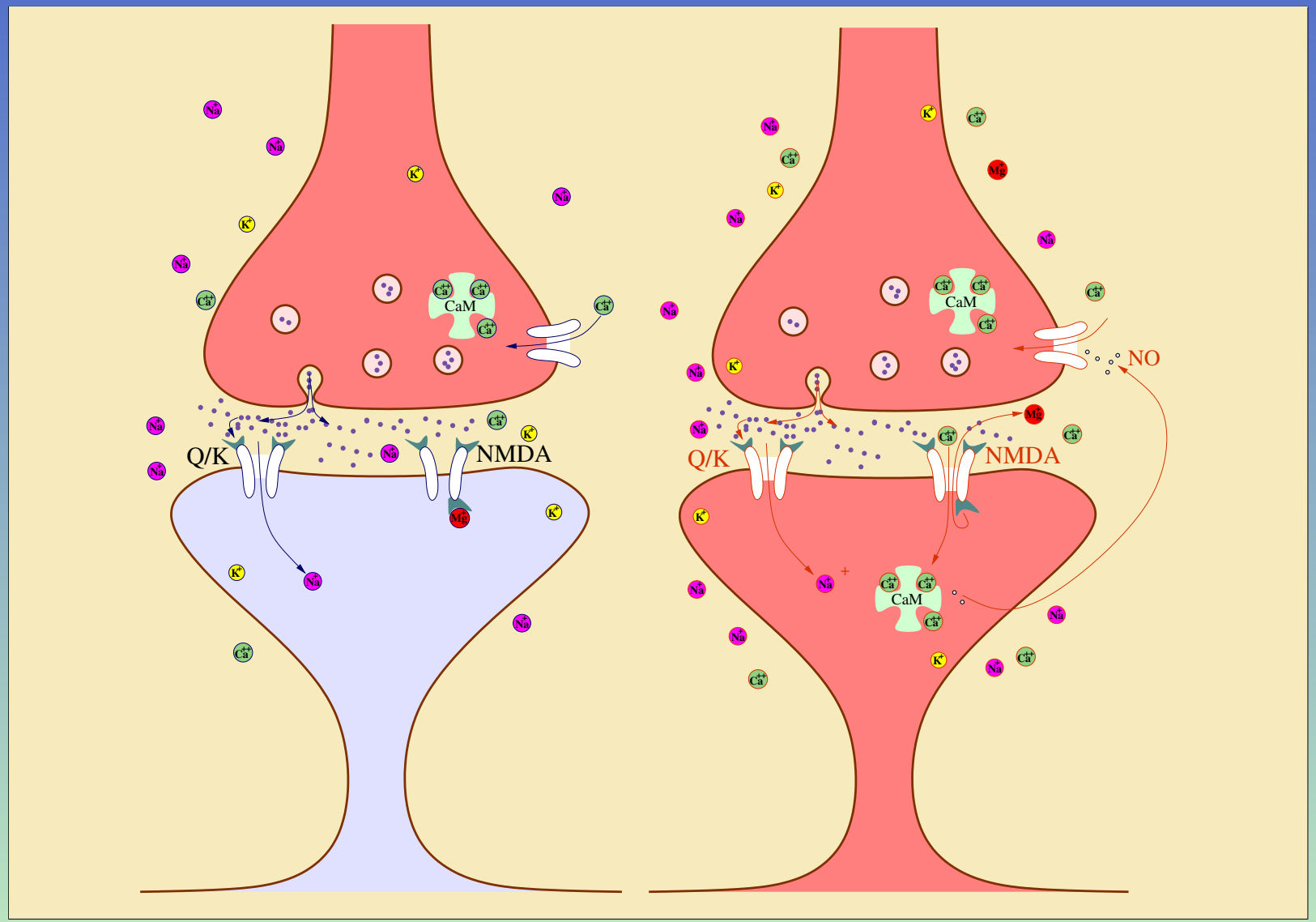

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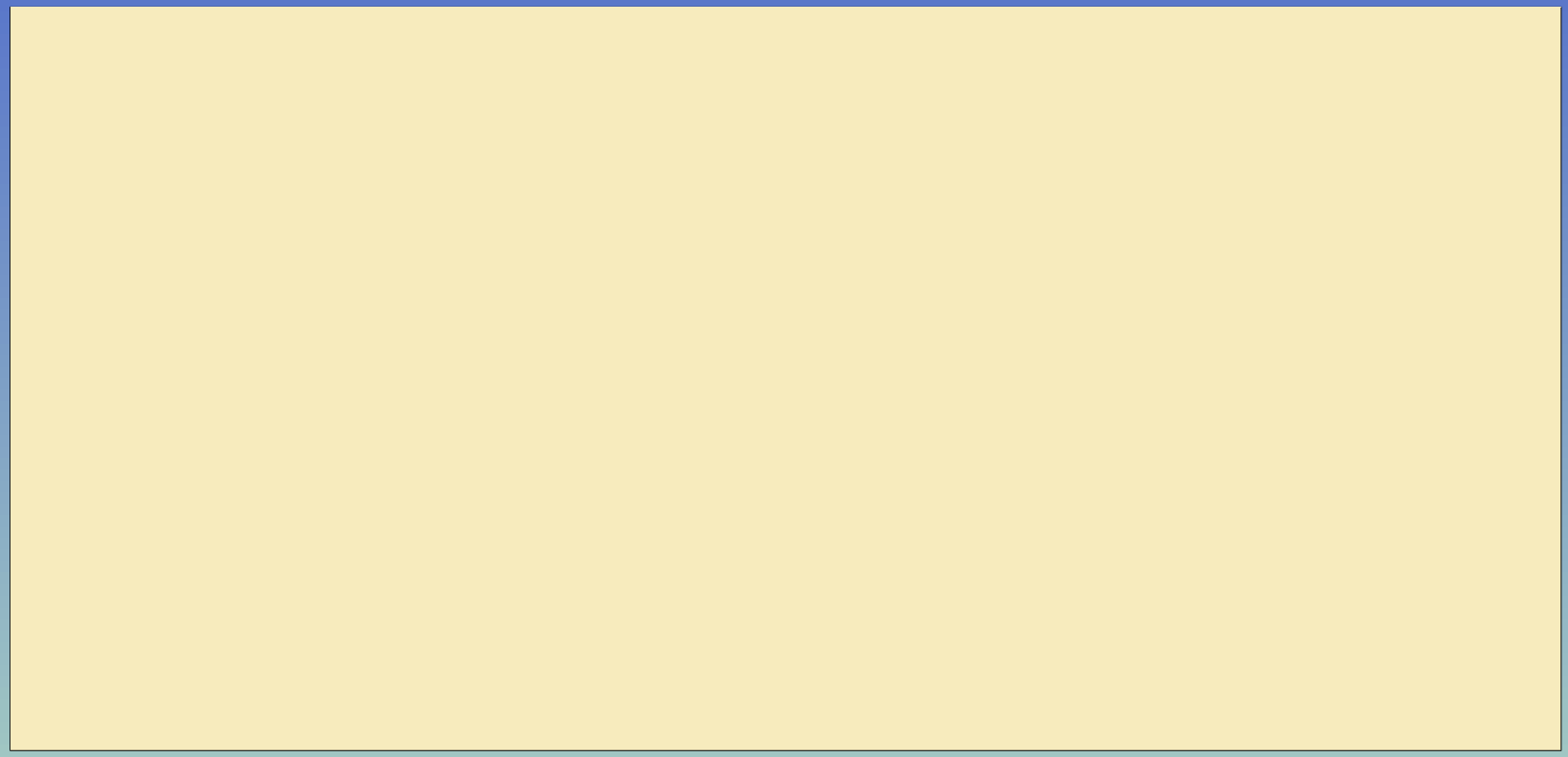
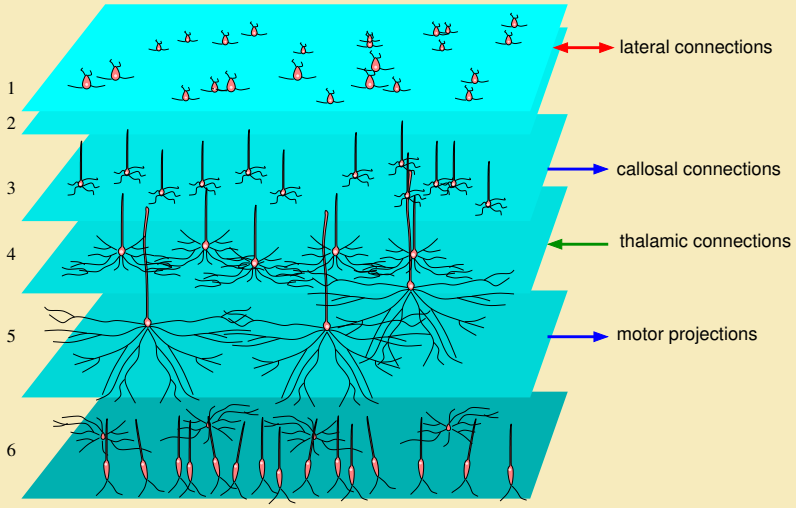
Where the brain computational power comes from?



Where the brain computational power comes from?



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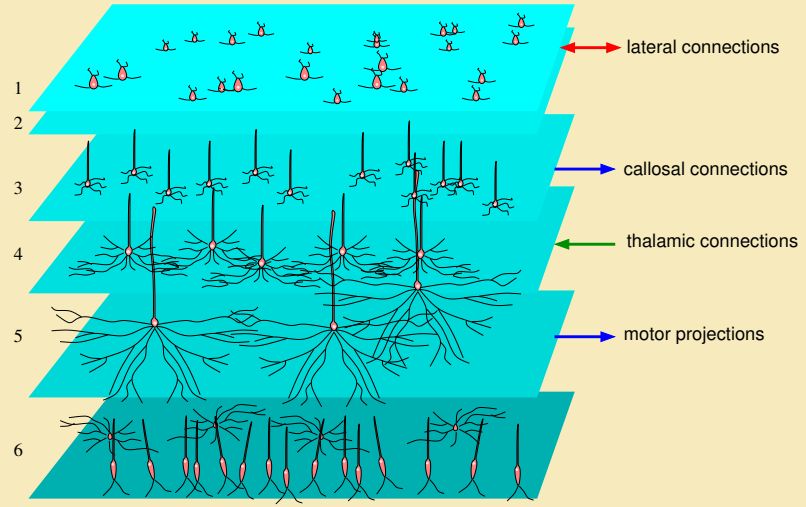

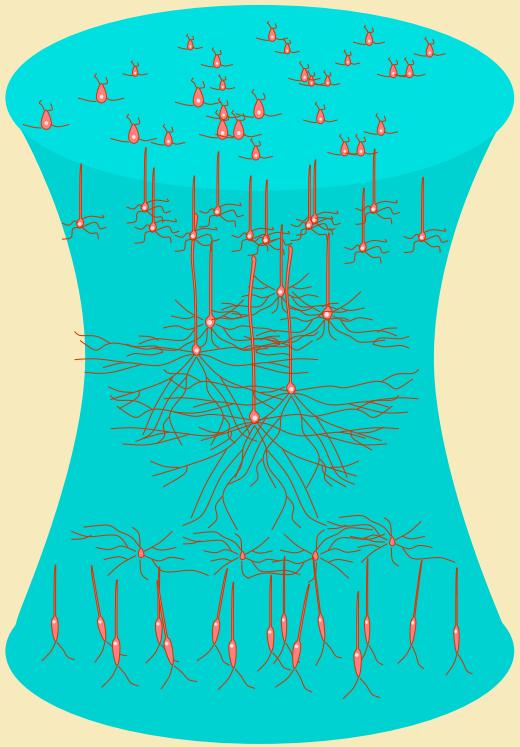

Searching for a canonical circuit

David Marr, 1970, *A theory for cerebral neocortex*

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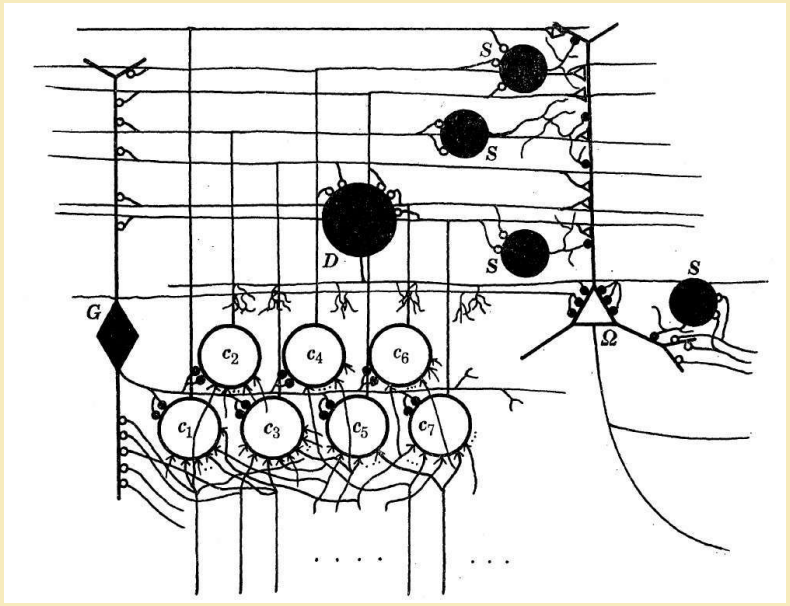

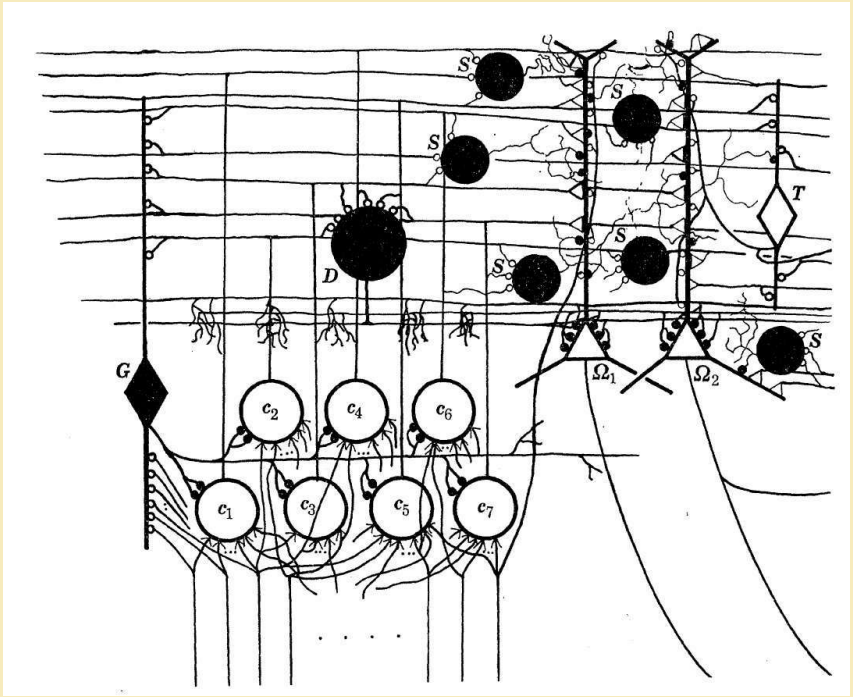

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Gordon M. Shepherd, 1988, *A basic circuit for cortical organization*

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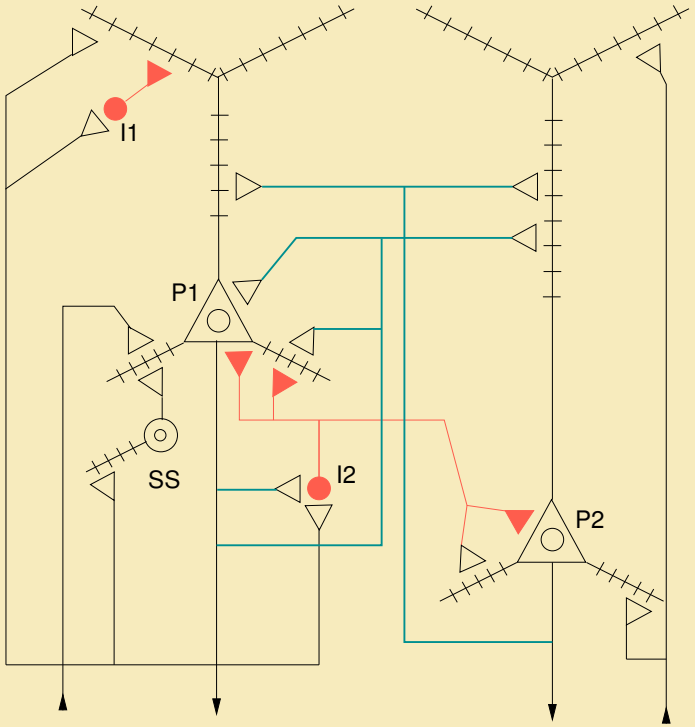

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Douglas, Martin and Whitteridge 1989, *A Canonical Microcircuit for Neocortex*

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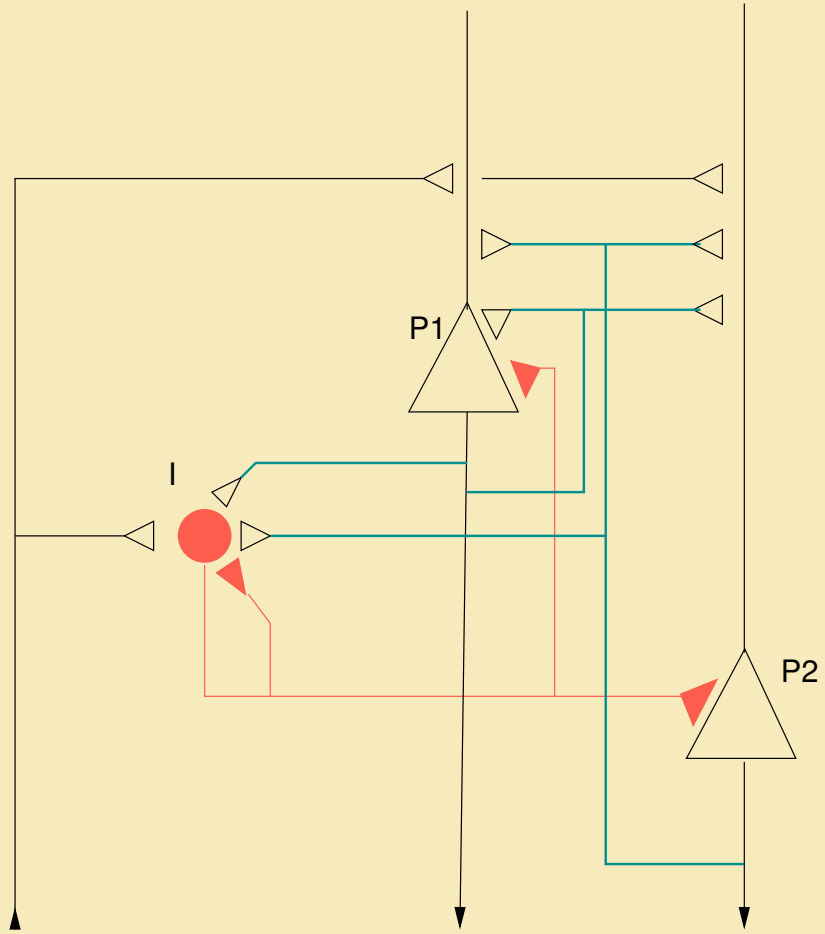
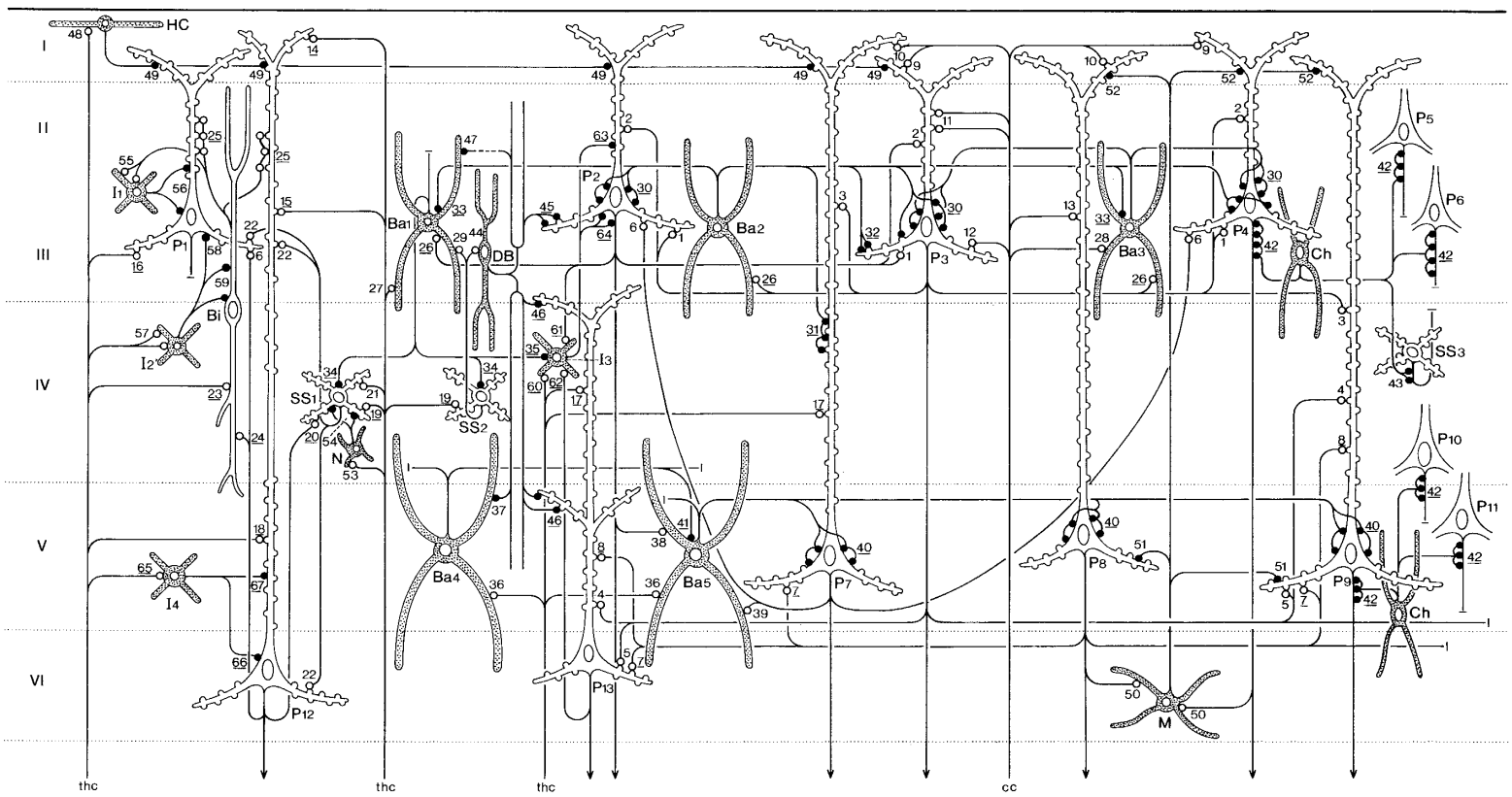


A less canonical circuit

Rudolf Nieuwenhuys, 1994, *The neocortex*



. . . thank you for your attention