

# KOHNO LAB.

## Analyze by Mimicking the Brain



Department of Informatics and Electronics  
 LIMMS/CNRS-IIS (IRL2820) International Collaborative Research Center  
 Center for Dependable Socio-information Platform

Neuromimetic Systems

Department of Electrical Engineering and Information Systems, Graduate School of Engineering  
 Department of Mathematical Informatics, Graduate School of Information Science and Technology

<https://www.neumis.iis.u-tokyo.ac.jp>

### Silicon Neuronal Networks

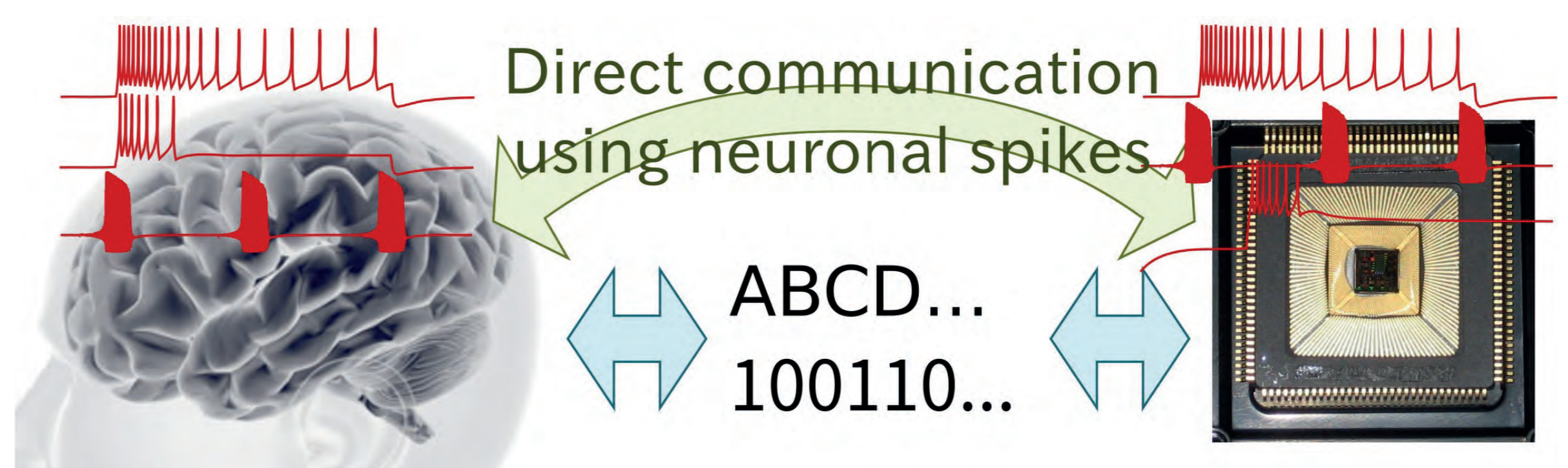
#### — Electronic circuit copies the nervous system —

Silicon neuronal network is the electronic circuit composed of electronic circuit versions of neuronal cells and synapses. It reproduces electro-physiological activities in the nervous system in real-time or faster.

#### Final goal is to realize “Brain-compatible AI”

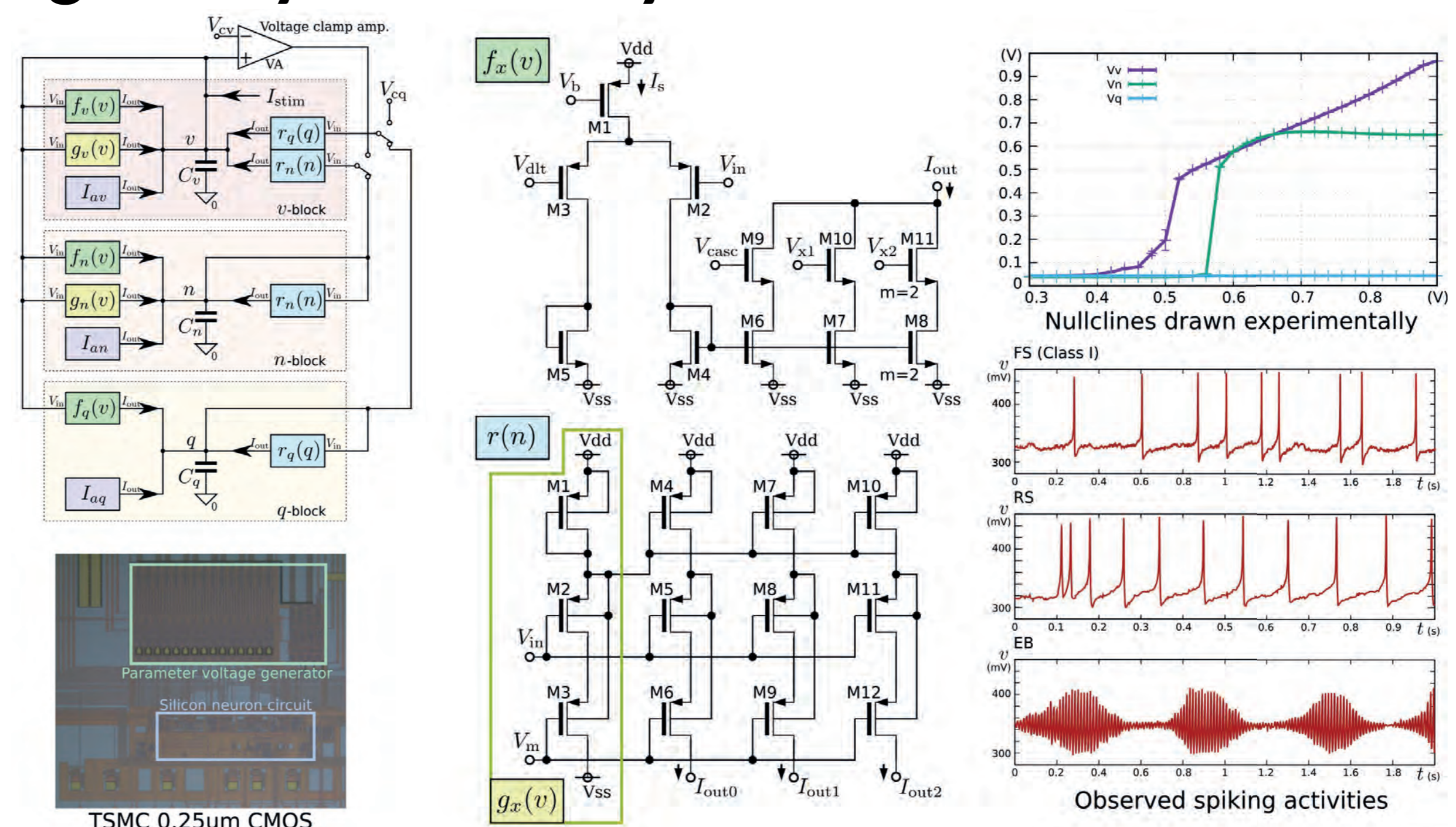
Features compared to current AI:

- Capable of direct communication with the brain without using symbols or languages.
- Efficient processing of non-linguistic information such as sensations and sense.
- Efficient learning with small amount of data similarly to the brain.
- Applicable to neuro-prosthesis devices



#### Analog neuromimetic circuits designed by the theory of nonlinear mathematics

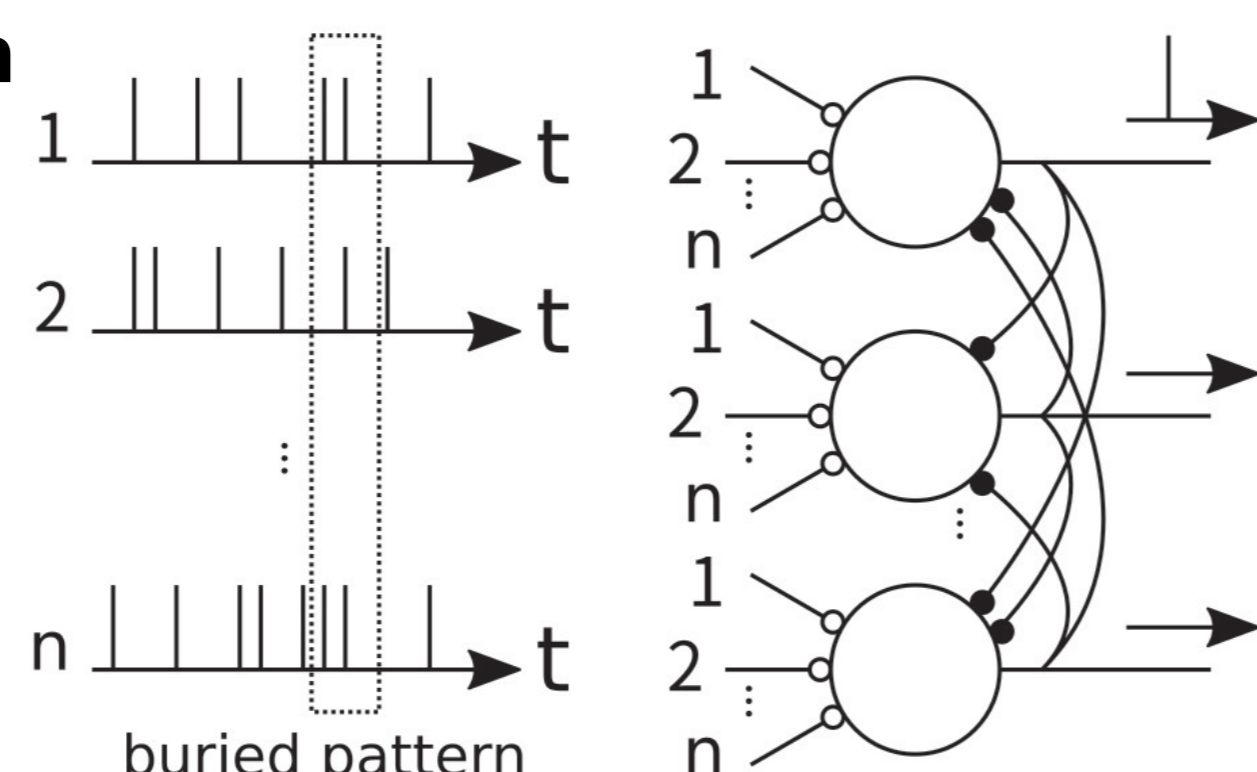
- **Ultralow-power**
- 7nW / neuron
- 2pW / synapse
- 0.25μm CMOS process
- Power supply voltage 1V
- Supports important brain cells  
 7 types of cells including:  
 Regular Spiking cells  
 Fast Spiking cells  
 Elliptic Bursting cells



#### Towards reproduction of information processing in the brain

- **Biologically realistic models** that differ from current AI models such as deep learning.

Masquelier’s spatio-temporal pattern detection from noisy spike trains by single layer network with lateral inhibition



Insect olfactory network on low-power silicon Neuronal network

