Seamless Integration of Neurons with CMOS Microelectronics

Fact Sheet

Project Information

NEUROCMOS

Grant agreement ID: 267351

Status
Closed project

Start date
1 June 2011

End date
31 May 2016

Funded under
FP7-IDEAS-ERC

Overall budget
€ 2 498 000

EU contribution
€ 2 498 000

Hosted by
EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH

Switzerland

Objective

We propose to seamlessly integrate advanced microelectronics and living neuronal cells in a comprehensive and interdisciplinary approach to significantly advance the understanding of neuronal behaviour. The project includes (a) the development of a novel multifunctional microelectronics chip platform in complementary metal oxide semiconductor (CMOS) technology, which serves to enable (b) key neurobiological and neuromedical research on network dynamics and plasticity of rodent neuronal networks and visual encoding in retiae, and (c) the necessary concurrent development of algorithms and models to efficiently process and maximally harness the unprecedented quality of the obtained data.

Neuronal or retinal preparations, such as acute and organotypic brain slices (retinae) or primary cultured, dissociated cells, will be directly placed or grown atop dedicated CMOS microelectronics chips. The chips will feature multiple functions, since neurons carry and pass signals to each other using electro-chemical mechanisms:
electrophysiological recording & stimulation, in closed loop & real time, as well as highly spatially resolved impedance measurements and detection of neuroactive chemical compounds. The chips will be capable of delivering any of these functions to arbitrarily selectable individual cells or even subcellular units, and, at the same time, of interacting with a multitude of cells or complete neuronal networks. Along with imaging (light, fluorescence), pharmacological, and/or genetic methods, the developed chip platform will be used to study neuronal network dynamics, synaptic and axonal plasticity, relevant for many brain diseases, as well as visual encoding in the retina. Efficient data handling and spike sorting algorithms will be developed to facilitate these investigations. The multidimensional data will then be used to establish detailed models of neurons and neuronal networks.

Field of science

/natural sciences/physical sciences/electromagnetism and electronics/electrical conductivity/semiconductor
/medical and health sciences/clinical medicine/ophthalmology
/natural sciences/physical sciences/electromagnetism and electronics/microelectronics

Programme(s)

Topic(s)

Call for proposal

ERC-2010-AdG_20100224

Funding Scheme

ERC-AG - ERC Advanced Grant

Host institution

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH

Address Activity type EU contribution
Raemistrasse 101 Higher or Secondary € 2 498 000
8092 Zuerich Education Establishments
Beneficiaries (1)

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH
Switzerland
EU contribution
€ 2 498 000

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Activity type
Higher or Secondary Education Establishments

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