Electrogenetics – Shaping Electrogenetic Interfaces for Closed-Loop Voltage-Controlled Gene Expression

Fact Sheet

Project Information

ElectroGene

Grant agreement ID: 785800

DOI
10.3030/785800

Start date
1 November 2018

End date
31 January 2025

Funded under
EXCELLENT SCIENCE - European Research Council (ERC)

Total cost
€ 2 500 000

EU contribution
€ 2 500 000

Hosted by
EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH
Switzerland

Objective

Man and man-made electronic systems share the same ecosystem, and yet work radically differently. Human metabolism uses ion gradients across insulated membranes to simultaneously process slow analog chemical reactions and communicate information in multicellular systems via soluble/volatile molecular signals. By contrast, electronic systems use multicore central processing units to control the flow of electrons through

insulated metal wires with gigahertz frequency and communicate information across networks via wired/wireless connections. With the advent of the internet of things, networks of interconnected electronic devices will reach the processing complexity of living systems, yet they remain largely incompatible with biological systems. Wearable electronics can profile physical parameters such as steps and heartbeat, and Google's proposal to develop glucose-monitoring contact lenses has triggered a wave of interest in harnessing the full potential of bioelectronics for medical applications. Yet this vision remains limited to diagnostics. Capitalizing on our mind-controlled and smartphone-adjustable optogenetic drug-dosing devices, ElectroGene will establish the foundations of electrogenetics, the science of creating electro-genetic interfaces that enable direct two-way communication between electronic devices and living cells. ElectroGene consists of three pillars, (i) voltage-triggered gene expression, (ii) genetically programmed electronics and (iii) wireless-powered implants providing closed-loop bioelectronic control, which allow real-time monitoring of metabolic conditions (diagnosis), enable remote-controlled production and dosing of protein therapeutics by implanted designer cells (treatment), and manage closed-loop control between cells and electronics, thus linking diagnosis and therapy to block disease onset (prevention). ElectroGene design principles and devices will be validated in proof-of-concept preclinical studies for the treatment of diabetes.

Fields of science

natural sciences › computer and information sciences › **internet**
engineering and technology › electrical engineering, electronic engineering, information engineering › electronic engineering › computer hardware › **computer processors**
natural sciences › biological sciences › biochemistry › biomolecules › **proteins**
natural sciences › biological sciences › ecology › **ecosystems**
medical and health sciences › medical biotechnology › **implants**

Programme(s)

H2020-EU.1.1. - EXCELLENT SCIENCE - European Research Council (ERC)
MAIN PROGRAMME

Topic(s)

ERC-2017-ADG - ERC Advanced Grant

Call for proposal

ERC-2017-ADG

See other projects for this call

Funding Scheme

ERC-ADG - Advanced Grant

Host institution

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH

Net EU contribution

€ 2 500 000,00

Address

Raemistrasse 101
8092 Zuerich
Switzerland

Region

Schweiz/Suisse/Svizzera › Zürich › Zürich

Activity type

Higher or Secondary Education Establishments

Links

Contact the organisation Website
Participation in EU R&I programmes
H2020 collaboration network

Non-EU contribution

€ 0,00

Beneficiaries (1)

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE ZUERICH

Switzerland

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EC signature date: 29 May 2018
Last update: 18 August 2022
Record number: 216125

Permalink: https://cordis.europa.eu/project/id/785800