MINERVA
Project ID: 616922
Funded under: FP7-IDEAS-ERC

Communication Theoretical Foundations of Nervous System Towards BIO-inspired Nanonetworks and ICT-inspired Neuro-treatment

From 2014-03-01 to 2019-02-28, ongoing project

Project details

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<th>Total cost:</th>
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<td>EUR 1 757 039</td>
<td>ERC-CG-2013-PE7 - ERC Consolidator Grant - Systems and Communication Engineering</td>
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<th>EU contribution:</th>
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<td>United Kingdom</td>
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Objective

“There's Plenty of Room at the Bottom”, stated by Nobel laureate Richard Feynman, describes the possibility of manipulating individual atoms and molecules to realise nanomachines. Emerging nanoscale applications mandate enabling nanomachines to communicate and form nanonetworks to overcome the limitations of a single one. Thus, our aim is to find the answer to the profound question, i.e., “is the room down there sufficient for a communication network?” Thanks to natural evolution, the affirmative answer is right inside us. Human body is a large-scale communication network of molecular nanonetworks composed of billions of nanomachines, i.e., cells, which use molecules to encode, transmit and receive information. Any communication failure that is beyond the recovery capabilities of this network leads to diseases. In this project, first, (1) we will investigate the communication theoretical foundations of nanoscale neuro-spike communication channels between neurons. Second, (2) we will study multi-terminal, i.e., multiple-access, relay, broadcast, neuro-spike channels and nervous nanonetwork in terms of communication theoretical metrics. Third, (3) we will validate our channel and nanonetwork models with physiological data, and develop a nervous nanonetwork simulator (N4Sim). Finally, (4) we will develop the first nanoscale bio-inspired communication system for ICT-inspired neuro-treatment for spinal cord injury, i.e., nanoscale artificial synapse, which will mimic neuron behaviour by realising both electrical and nanoscale molecular communications. The MINERVA project will pave the way for the realisation of emerging nanonetwork applications with significant societal impact, e.g., intra-body networks for health monitoring, drug delivery, chemical and biological attack prevention systems. The project will help develop the future ICT-inspired treatment techniques for communication related neural disorders.

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