Projet FP7 – NANOCI

Nom du projet	Nanotechnology based cochlear implant with gapless interface to auditory neurons – NANOCI
Call	NMP-2011-1.4
Type de projet	Small or medium-scale focused research project
Rôle de la HES-SO	Participant
Chercheur impliqué	Herbert KEPPNER (HE-ARC Ingénierie)
Participants	Universität Bern (Switzerland) – Coordinateur ; Bar Ilan University (Israel); Tampereen Yliopisto (Finland); Eberhard Karls Universität Tübingen (Germany); Med-El Elektromedizinische Geräte GmbH (Austria); EMC Microcollections GmbH (Germany) ; Haute école spécialisée de Suisse occidentale (Switzerland) ; Uppsala Universitet (Sweden) ; SCIPROM sarl (Switzerland).
Budget global	4.914 millions euro / financement UE : 3.599 millions euro
Durée	36 mois, début le 1.9.2012
Résumé	Over 60 million of citizens in the EU suffer from hearing loss with its associated restrictions. In severe cases, hearing can only be restored by surgically implanting a neuro-prosthesis called cochlear implant, which directly stimulates the auditory nerve. The bottleneck for optimal stimulation is caused by the anatomical gap between the electrode array and the auditory neurons in the inner ear. As a consequence, current devices are limited through: (i) Low frequency resolution, hence poor sound quality. (ii) Strong signal amplification, hence high energy consumption responsible for significant battery costs and for impeding the development of fully implantable systems. Recent findings indicate that auditory nerve fibres can grow under neurotrophin stimulation towards the electrodes, which opens the door to address all issues simultaneously. NANOCI aims at developing a neuro-prosthesis with a gapless interface to auditory nerve fibres. The neurites will be attracted and guided by an innovative, nanostructured gel matrix containing diffusible and surface-bound neuro-trophic compounds towards the functionalized, neuro-trophic electrode array surface. The long-lasting operation without interface degradation, reduced bio-fouling and improved conductivity will be achieved by nano-structuring the array surface using (i) various functional nano-materials, including carbon nanotubes, combined with (ii) structuration methodologies such as ion implantation and sacrificial nanoparticle embedding in parylene, SOLID (solid on liquid deposition) encapsulation, and sono-chemistry. Components will be validated using appropriate bioassays including human auditory neurons in vitro. In parallel, software models will be developed to exploit the bidirectional, gapless interface. Fusing all developments, an animal-grade, pilot nanoCI-device is manufactured and tested in vivo. This will allow to assess the feasibility of a future, cost-efficient, and fully implantable neuro-prosthesis with substantially increased sound quality.
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